COMPARITIVE STUDY BETWEEN SURGICAL AND NONSURGICAL MANAGEMENT IN PATIENTS WITH OBSTRUCTIVE JAUNDICE DUE TO CHOLEDOCHOLITHIASIS

By

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In

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Under the guidance of

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation **"COMPARITIVE STUDY BETWEEN SURGICAL AND NONSURGICAL MANAGEMENT IN PATIENTS WITH OBSTRUCTIVE JAUNDICE DUE TO CHOLEDOCHOLITHIASIS "** is a bonafide and genuine research work carried out by me under the guidance of PROF.P.RAGUMANI., M S., Professor, Department of General Surgery, MMC & RGGGH , CHENNAI.

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is a bonafide

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LIST OF ABBREVATIONS USED

1. CBD Common bile duct

2. CBDE Common bile duct exploration

3. DB Direct Bilirubin

4. DOA Date of admission

5. DOD Date of discharge

6. DOS Date of Surgery

7. ERCP Endoscopic retrograde cholangiopancreatography

8. GB Gall bladder

9. IP.No In patient number

10. IOC Intra operative cholangiogram

11. LFT Liver function test

12. LRTI Lower respiratory tract infection

13. MRCP Magnetic resonance cholangiopancreatography

14. SSI Surgical site infection

15. TB Total bilirubin

16. TDS Trans duodenal sphincterotomy

17. USG Ultrasonography abdomen

18.PT Prothrombin time

ABSTRACT:

BACKGROUND:

Obstructive jaundice is a frequent manifestation of biliary tract disorders. Evaluation and management of patients with jaundice is one of the challenging problems confronting to the surgeon. CBD stones usually remain asymptomatic. Stones in biliary tree is the most common cause of obstructive jaundice. 10% to 18% of patients undergoing cholecystectomy for gallstones have CBD stones.

OBJECTIVE:

1.ERCP versus open surgical bile duct clearance.

2. To compare the post procedural morbidity and mortality

MATERIALS AND METHODS:

50 Patients with obstructive jaundice due to choledocholithiasis in Rajiv Gandhi Government General hospital were studied between June 2011 to December 2013

RESULTS:

ERCP was less successful than open surgery in CBD stone clearance . There was increased rate of post operative morbidity in patients treated with open surgery.

CONCLUSION:

Open surgery has got high post procedural morbidity and low failiure rate when compared to ERCP.

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1.INTRODUCTION

cholestatic jaundice is a frequent manifestation of biliary tract disorders. Evaluation and management of patients with jaundice is one of the challenging problems confronting to the surgeon.

Cholelithiasis is a common surgical problem which makes Cholecystectomy one of the most frequently performed surgical procedures. CBD stones complicate the working and management of cholelithiasis necessitating additional diagnostic and therapeutic procedures and adds to morbidity and mortality of gall stone disease.

Although the stones in the CBD may be silent, the development of symptoms is potentially serious; obstructive jaundice, ascending cholangitis, acute pancreatitis are all associated with serious morbidity and at times, mortality which need immediate attention.

Common bile duct stones are present in approximately 5% of the patients undergoing elective cholecystectomy and 10% of patients with acute cholecystitis. No single blood test or combination of blood tests can predict whether or not a CBD stone is present. Intraoperative cholangiography is a gold standard for diagnosis , but CBD stones can be diagnosed preoperatively with ultrasound,ERCP or MRCP.

If CBD stones are diagnosed preoperatively, several different treatment modalities can be utilized. The factors that determine the optimal approach include the patient's age and general condition.

In the era of open cholecystectomy, most CBD stones found at surgery were managed surgically with only a minority managed by the alternative,namely, endoscopic retrograde cholangiopancreatography with or without endoscopic sphincterotomy (ERCP/ES) (Fletcher 1994). Studies suggested that surgical CBD stone extraction was the recommended option.

2. REVIEW OF LITERATURE

HISTORICAL PERSPECTIVE

The first open cholecystectomy was performed by Lagenbuch in 1882 .The first surgical exploration of the common bile duct was done in 1890 by Ludwig Courvoisier, a Swiss surgeon who made an incision in the common bile duct and removed a gall stone.

Choledocholithiasis is present in approximately in 10% of those who present for cholecystectomy. Definitive treatment of these patients include cholecystectomy and clearance of the entire ductal system. Courvoisier answered this challenge in the era of open biliary surgery in 1890, nearly eight years after Langenbuch performed his first cholecystectomy in 1882.

One of the first descriptions of common bile duct pathology was the report of cholangitis by Jean Martin Charcot, a French physician. In 1877, he published the clinical symptoms associated with the passage of common duct stones that we now know as Charcot's Triad- Right upper quadrant pain, fever with chills and jaundice . These clinical findings were extended by Telfer Reynolds, a hepatologist in Los Angeles, who recognized the presence of hypotension and altered mental status related to sepsis in cholangitis. Imaging of the biliary tree began with cholecystography by Evarts Graham and Warren Cole in 1924 .

Transhepaticocholangiography was developed by Carter and Saypol in 1952. The introduction of intraoperative cholangiography by Mirrizi in 1934 helped to further refine the indications for the CBD exploration.

An ironic historic vignette involves one of America's most prominent surgeon – William Stewert Halsted and his travails with the CBD . William Halsted died in 1922 following complications from his own two bile duct operations.

Hans Kehr, a German surgeon, contributed to biliary surgery by his book "The Practice of Biliary Tract Surgery in Words and Pictures" and development of the T-tube, which is still known as Kehr's Tube. For surgeons practicing from 1940 to 1990, open CBD exploration was a commonly performed operation.

The development of ERCP in 1968 and endoscopic spincterotomy in 1974 allowed removal of common duct stones without a laparotomy. Though initially applied to patients felt to be poor surgical candidates, endoscopic transpapillary therapy gained increasing popularity over the next 20 years. One hundred years later (from the first cholecystectomy) in late 1980s, laparoscopic cholecystectomy was introduced, and soon became the standard of care for treatment. This was soon followed by the introduction of several minimally invasive techniques that have proven successful in treatment of choledocholthiasis in the laparoscopic era of biliary tract surgery.

ANATOMY

COMMON BILE DUCT(DUCTUS CHOLEDOCHUS) :

The common bile duct begins at the union of the cystic and common hepatic ducts and ends at the papilla of Vater in the second part of the duodenum. Length of CBD varies from 5 cm to 15 cm. The diameter of CBD varies from 4mm to 6 mm.

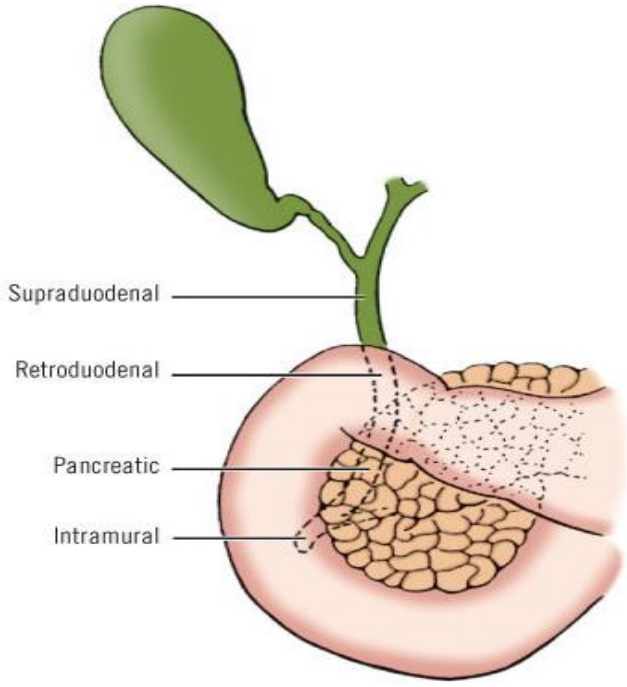
The common bile duct (CBD) can be divided into four portions or segments

1.Supraduodenal - average length of 2 cm

2. Retroduodenal – average length of 1.5 cm

3. Pancreatic – average length of 3 cm

4. Intraduodenal – average length of 1.1 cm.



Supraduodenal Portion

This part lies between the two leaves of the hepatoduodenal ligament, in front of the foramen of Winslow to the right of the hepatic artery, and anterior to the portal vein. One or more of the following may cross the supraduodenal portion anteriorly: right gastric, right hepatic, supraduodenal or even gastroduodenal artery. The relation of the right hepatic artery may lie to the right, left, anterior or posterior to the common bile duct.

Retroduodenal Portion

This part lies between the superior margin of the first part of the duodenum and the superior margin of the head of pancreas. The gastroduodenal artery is to the left and the posterosuperior pancreaticoduodenal artery crosses first anterior to the bile ducts and then posterior to the duct just before it enters the duodenum.

Pancreatic Portion

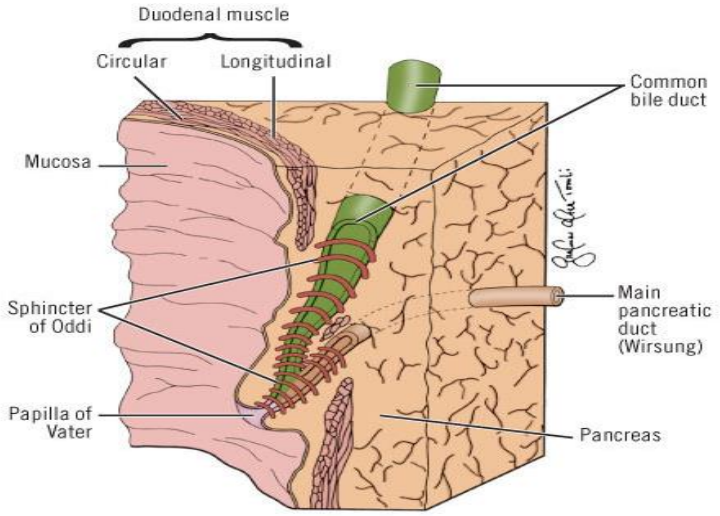
The pancreatic portion is covered by a pancreatic extension (tongue) in various proportions from completely covered (30%) to partially covered (44%) to uncovered (16.5%). The above description predicts the ease with which stone may be palpated after mobilization of Second part of the duodenum with Kocher's Maneuver.

Intramural:

This part passes obliquely through the duodenal wall together with main pancreatic duct. Within the wall, the length average 15 mm10 as it enters the wall,the common bile duct decreases in diameter from 5.7 to 3.3 mm11. The two ducts lie side by side with a common adventitia for several millimeters. The dividing septum becomes reduced to a mucosal membrane just before the confluence of the ducts.

The duodenal papilla (of Vater) lies at the end of the Intramural portion of the CBD. It is on the posteromedial wall of the second part of the duodenum. The distance of the papilla from the Pylorus is highly variable from 8 to 12 cm.

There is a complex of four sphincter composed of circular or spiral smooth muscle fibres surrounding the intramural portion of the CBD and pancreatic ducts. The sphincter is developmentally and functionally distinct from the duodenal musculature. The entire complex is called sphincter of oddi



Incision of 5 mm steps while testing with a suitable dilator will help limit the incision of papillotomy to the shortest length necessary. On mucosal surface, the duodenal papilla of vater is found where a longitudinal mucosal fold meets a transverse fold to form a T.The Ampulla is the common pancreaticobiliary channel below the junction of the ducts within the papilla.

It is classed into 3 types based on Michel's description .

Type 1. The pancreatic duct opens into the CBD, but at a variable distance from the orifice of duodenal papilla (85%).

Type 2. The pancreatic and CBD open separately on the duodenal papilla (5%).

Type 3. The pancreatic and CBD open into the duodenum at separate points (9%).

Diameter of the CBD

The diameter measured varies with procedure performed to measure it . (Surgical inspection, cholangiogram, USG).

A CBD has been considered to be definitely enlarged, when:

> 8mm Drouin, 1964

> 10 mm Roux et al, 1959

> 12 mm LeQuesne et al, 1959

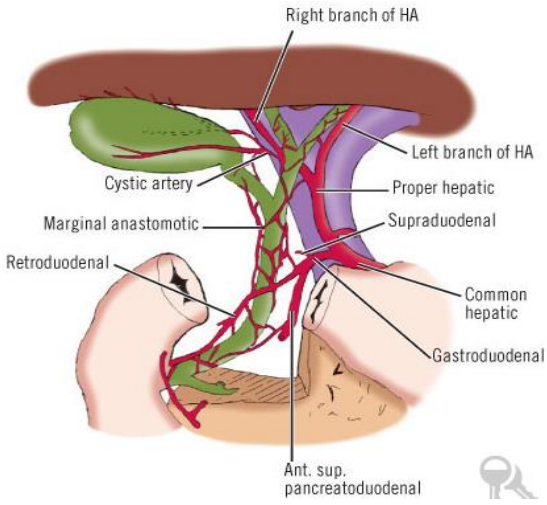
> 15 mm Longmire, 1963.

Hence, there is no consensus. But there is agreement on the fact that a CBD less than 5.7 mm is certainly normal and one over 10.8 mm indicates obstruction.

Ducts between these values must be considered equivocal. At 10.2 mm, the probability of pathology in the duct is 50%.

Arterial Supply of the CBD

The upper portion is supplied by the cystic artery. The lower portion is supplied by a branch from posteriosuperior pancreaticoduodenal and retroduodenal artery. There is a subepithelial, intramural and an epicholedocal plexus of vessels around the CBD. These provide collateral circulation between the cystic artery above and the superior pancreaticoduodenal artery below. Gastroduodenal branches to CBD runs on the side of CBD at 3 'o' clock and 9 'o' clock position.



Venous Drainage of the CBD

The upper portion drains via the cystic vein into the hepatic vein. An Epicholedocal venous plexus on the CBD helps the surgeon identify the CBD. However stripping of the CBD is not permissible.

Lymphatic Drainage

The CBD drains into pericholedocal nodes which in turn drain into preaortic nodes around the celiac and superior mesentric artery.

Nerve Supply

Both sympathetic and parasympathetic (vagal) fibres derived from the celiac plexus reach the biliary tract as they follow the hepatic artery and its branches. The action of sympathetic nerves is vasomotor but that of parasympathetic is not known. Complete vagotomy does not impair bile output but it appears to result in a permanently enlarged gall bladder .

CHOLEDOCHOLITHIASIS

Common bile duct stones are classified both by their point of origin as well as the time at which they are discovered relative to cholecystectomy.

A. Point of Origin:

1. **Secondary Bile Duct Stones:**

   These form in the gall bladder and pass down through the cystic duct into the CBD. Most CBD stones are of this type.Therefore, patients with CBD stones usually have gallstones. Even in cases where the gall bladder does not contain stone, chronic inflammatory changes in its wall and sludge in its Lumen indicate the presence of stones previously.

2.Primary Bile Duct Stone:

To prove, that a stone originated in the CBD, is difficult except in cases of gall bladder agenesis. Saharia et al proposed the following criteria for primary CBD stones.

Patient should meet all the criteria, viz :

- Previous cholecystectomy with/without CBD Exploration.
- At least two years of symptom free interval after previous biliary surgery.
- Soft friable brown stones/ sludge in CBD.
- Absence of a long cystic duct or biliary stricture due to previous surgery.

Primary CBD stones are associated with the biliary stasis and infection. They are usually brown pigment type, which are soft and crumble easily when manipulated. The causes of the biliary stasis, which lead to their development, include biliary stricture, papillary stenosis or sphincter of oddi dysfunction.The incidence of primary CBD stone varies from 4% to 56% in different studies. The incidence of secondary CBD stone is age sensitive and varies from 11% to 18% as older patient have had gallstones for a longer period of time.

B. In Relation to Cholecystectomy:

1. Retained:

CBD stones are defined as retained if they are discovered within 2 years of cholecystectomy. The stones have characteristics of secondary stones.

2.Recurrent:

CBD stones are defined as recurrent if they are detected more than 2 years following cholecystectomy.

NATURAL HISTORY OF CBD STONES

CBD stones may remain asymptomatic for long periods. Clinically silent passage into the duodenum is known to occur in CBD stones, when they cause symptoms, present with margin complications like cholangits or pancreatitis. The morbidity of CBD stone is mainly due to biliary obstruction. CBD stones usually come to rest at the lower end of the CBD, at the ampulla of vater. CBD obstruction causes the proximal duct to dilate and increases the pressure inside the duct. Normal intraductal pressure is 10 – 15 cm of H2O. This rises to 25-40 cm of H2O with complete obstruction. When the pressure increases to >15cm of H2O, bile flow decreases and flow stops at 30cm of H2O pressure. Therefore, during contact dissolution of retained CBD stone the pressure inside the duct should be monitored and maintained at below 15 cm of H2O. The degree and rate of onset of

obstruction and the amount of bacterial contamination of bile are the major factors that determine the symptoms. Acute obstruction usually causes biliary colic and Jaundice. Gradually developing obstruction may present with Jaundice alone. If bacteria proliferate cholangitis may result. In patients who have had recurrent bouts of cholangitis, the duct may become fibrotic and unable to dilate. If the obstruction is low grade and intermittent, the duct may not be dilated. If incomplete obstruction persists for a long time before a diagnosis is made secondary biliary cirrhosis with portal hypertension may develop which ultimately may progress to hepatic failure. To summarize the clinical cause may be complicated by acute gall stone pancreatitis, cholangitis or rarely hepatic abscess. The average time for choledocholithiasis to lead to biliary cirrhosis is 5 yrs depending on the extent of obstruction.

COMPOSITION OF CBD STONES

1.Primary Stones.

They usually are of the brown pigment variety. These tend to be lower in cholesterol content and higher in bilirubin content secondary to biliary stasis and bacterial infection.

2. Secondary Stones.

These are cholesterol stones in 75% and black pigment stones in 25% of patients. Cholesterol stones are formed in the presence of cholesterol saturation,

biliary stasis, and nucleating factors. The formation of black pigment stones is associated with hemolytic disorders, cirrhosis, ileal resections, prolonged fasting and total parenteral nutrition.

INDICATORS OF CHOLEDOCHOLITHIASIS.

INDICATOR	SENSITIVITY	SPECIFICITY
Cholangitis	11%	99%
Choledocholithiaisis on USG	38%	100%
Preoperative jaundice	36%	97%
Dilated CBD on USG	42%	96%
Jaundice	39%	92%
Elevated bilirubin	69%	88%
Eleated alkaline phosphatase	57%	86%
Pancreatitis	10%	95%
Acute cholecystitis	50%	76%
Elevated amylase	11%	95%

DIAGNOSIS AND EVALUATION

In the last decade, many refinements and advancements have been made in radiology; endoscopy and clinical laboratory testing that have improved the

diagnosis and evaluation of patients with choledocholilithiasis and cholangitis. In some respect, the available tests are so numerous that care must be exercised to avoid over utilizing them. A careful old-fashioned but time honoured history and physical examination will guide the clinician in the proper direction in most cases.

A patient with symptomatic CBD stones may have the following:

CLINICAL FEATURES

1) Pain.

Abdominal pain commonly is intermittent but may be constant also. The pain is usually present as a deep visceral, mid epigastric pain and is often associated with nausea and or vomiting. Presence of fever points to cholangitis whereas in 20% of patients, back pain may be the prominent symptom and raises the possibility of associated pancreatitis.

2) Obstructive Jaundice.

A small stone passes into the bile duct and impacts in the ampulla, causing pain and jaundice. The severity of jaundice depends on the duration of obstruction, but as the stone passes on, the jaundice resolves spontaneously. More commonly, there is a larger stone or stones within a dilated

bile duct. Sometimes, the number of stones in the duct leads to significant impairment of bile flow. At other times, a stone moves up and down within the duct and acts as a 'ball Valve', causing pain and jaundice when it impacts, but allowing the symptoms to resolve spontaneously as the stone floats up. The site of impaction is usually immediately above the ampulla, but it may be above a fibrotic narrowing in the bile duct, caused by the stone themselves. Complete impaction of a stone causes severe, progressive jaundice. Stones in the bile duct cause pain. However, from pain alone it is not easy to diagnose obstructive jaundice due to stone from that due to malignant disease.

3) Ascending Cholangitis

The classic presentation of patient with cholangitis was described as fever, jaundice and abdominal pain by Charcot .However, 1/3 to 1/2 of patients will not have the complete triad. Reynolds and Dargan added the presenting symptom of shock and mental obtundation to the triad, to describe a group of patients with severe forms of the disease. Cholangitis is always associated with some degree of obstruction within the bile duct; stones in the duct are the cause in 80% of cases. Bile duct obstruction by stone release cytokine, which activate bacterial biofilm on these stones. There is a synergy of aerobic (E.coli, S.fecalis) and anerobic (B.fragilis, clostridium perfringens).

4) Acute Pancreatitis

Impaction of small stone at the ampulla and occlusion of pancreatic duct is a cause of acute pancreatitis. An early ultrasonographic examination of the biliary tract is therefore essential in every patient who is admitted with acute pancreatitis, particularly, if there is any change in the liver function tests. A few have evidence of a stone in the bile duct and an immediate endoscopic sphicterotomy and extraction of the stone may abort the episode of pancreatitis. The following signs may be present:

Patient may be icteric and toxic, with high fever and chills or may appear to be perfectly healthy. A palpable gall bladder is unusual in patients with obstructive jaundice from common duct stone because, the obstruction is transient and partial, and scarring of the gall bladder renders it inelastic and non-distensible (Courvoisier's law). Tenderness may be present in the right upper quadrant but is not as marked as in acute cholecystitis. Tender hepatic enlargement may occur.

BIOCHEMICAL PARAMETERS:

1. Serum Bilirubin:

In the routine clinical laboratory, total and direct reacting bilirubin are determined. Conjugated (direct) can be accurately assessed by high performance liquid chromatography; this has been found highly specific for cholestatic liver disease. A rise in serum bilirubin often appears within 24 hr after the onset of

symptoms. The absolute level usually remains under 10 mg/dl and most are in the range of 2-4 mg/dl. The direct (conjugated) fraction exceeds the indirect, but the later becomes elevated in most cases. Bilirubin levels do not ordinarily reach the high values seen in malignant tumour because the obstruction is usually transient and incomplete. In fact, fluctuating jaundice is so characteristic of choledocholithiasis that it fairly reliably differentiates between benign and malignant obstruction. After long standing obstruction bilirubin becomes covalently bound to serum albumin C, the so called delta bilirubin . This fraction disappears from serum with half life of albumin (20 days); this phenomenon accounts for the slow resolution of jaundice after relief of standing obstruction in spite of otherwise normal liver function.

2.Serum Alkaline Phosphatase

The serum alkaline phosphatase level usually rises after biliary obstruction and may be the only chemical abnormality in patients without jaundice. The elevation of alkaline phosphatase in hepatobiliary disease is due to increased synthesis perhaps, stimulated by bile acids39. This explains why in patients with acute biliary obstruction, the elevation of alkaline phosphatase often lags behind the onset of symptom and even jaundice. When obstruction is relieved, the alkaline phosphatase and bilirubin levels return to normal within 1 – 2 weeks with the

exception that the former may remain elevated longer if the obstruction was prolonged.

3. Gamma-glutamyl transpeptidase (GGT)

GGT increases markedly (upto 40 fold) in mechanical bile ductobstruction. It has been proposed that the ALT/GGT ratio was better able to differentiate between obstructive jaundice and hepatitis than alkaline phosphatase or any of the enzymes taken alone.

RADIOLOGICAL IMAGING

Abdominal Sonography

This is the first imaging investigation of choice to be used as it needs no special preparation, involves no ionizing radiation, simple to perform, provides accurate anatomic information, is portable and is non-invasive. It has been the single most valuable screening tests in the jaundiced patient in recent years . The presence of associated gall bladder stone can be confirmed in >98% and dilation of the intrahepatic biliary system can be identified.Unfortunately, its sensitivity for the detection of the CBD stone is only 15% to 30%. This is because the distal end of CBD is frequently obscured by duodenal or colonic gas. The presence of a stone can be inferred by the presence of dilated CBD, This has a sensitivity of 75%, the normal CBD measures 6 mm on ultrasound, and USG can often determine the

cause of obstruction. The demonstration of stones in the CBD depends upon their size and position. Large stones(>5 mm) usually can be visualised. Smaller stones may not cast an acoustic shadow and are more difficult to detect because, they lodge further down the duct, where duodenal gas may degrade the image. Ultrasound has proved to be thoroughly reliable for detection of biliary dilation but it can be misleading in rare cases in which a partial obstruction is examined early, after the onset of obstruction before the dilation has developed .

Endoscopic Ultrasound

Endoscopic ultrasound is a semi-invasive test that can be performed with very low rates of complications(< 0.1%) . The negative predictive value of endoscopic ultrasound is more than 97%. Therefore, when endoscopic ultrasound is negative for CBD stones, ERCP or intraoperative cholangiography can be avoided.

Magnetic Resonance Cholangiopancreatography (MRCP)

MRCP has recently been developed as another non-invasive means of imaging the biliary tract. MRCP can diagnose CBD stones with sensitivity of 90%, a specificity of 100% and an overall diagnostic accuracy of 97%. The main

advantage is that it allows for direct imaging of biliary tract without the need for contrast or an invasive procedure. The disadvantages include high cost, lack of availability and lack of therapeutic capacity. MRCP has been used to screen patients at low and moderate risk of having CBD stones prior to ERCP. A normal MRCP avoids the need for ERCP.

Intraoperative Cholangiography (IOC)

IOC can be successfully accomplished in more than 95% of the cases. It should be carefully evaluated for filling defects within the ducts, presence of contrast in the duodenum and the intrahepatic biliary anatomy. Debate continues over the need to perform routine intraoperative cholangiography. Advocates of its routine use argue that asymptomatic CBD stones can be identified and biliary injury can be prevented by performing it routinely. Critics suggest that incidence of retained stones is no greater when cholangiography is performed selectively, based on clinical and laboratory criteria. The indicator for performing cholangiography during cholecystectomy include

- A dilated CBD
- A wide cystic duct
- Palpable CBD stones
- Elevated LFT
- History of cholangitis, pancreatitis

If these criteria are strictly followed, approximately 30% of the patients will require IOC at the time of cholecystectomy. IOC can identify the size, number and location of CBD stones in addition to defining biliary anatomy. This information is critical in choosing the most appropriate treatment for CBD stones.

PREOPERATIVE PREPARATION OF THE PATIENT WITH OBSTRUCTIVE JAUNDICE.

Adequate timing of the surgical intervention and preparation of the patient for surgery are essential in management of patients with obstructive lesions of the biliary tract. Undue delays exceeding 3-4 weeks increase both morbidity and mortality rates following surgical intervention. Adequate preparation entails the correction of metabolic abnormalities, improvement of the general condition o the patient and measures to minimize the incidence of complications associated with prolonged or severe cholestasis include:

1. Infections: cholangitis, septicemia, wound infection
2. Disorders of the clotting mechanism
3. Renal failure
4. Liver failure
5. Fluid and electrolyte abnormalities.

No evidence exists to support that wound healing is impaired in the presence of jaundice. Wound healing problems are largely confined to patients with malignant obstruction and are result of the underlying disease and its association with poor nutritional state.Oral diet is the safest,as enteral nutrition is considered essential for the maintenance of the mucosal integrity of the gut against bacterial translocation. Hypokalemia is frequently present and should be managed. Intravenous isotonic saline should not be administered.

PREVENTION OF INFECTIVE COMPLICATIONS:

Infections of the biliary tract is much more commonly present in ductal calculous disease. In the absence of stenting, the majority of infections associated with biliary tract disorders are aerobic in origin and most commonly due to Gram negative bacilli. The use of prophylactic antibiotic therapy with a cephalosporin or aminoglycoside or piperacillin has shown to reduce the incidence of postoperative wound infections, cholangitis and septicemia. Bacterial proliferation in the bile following exploration of the CBD and insertion of a T-tube is extremely common and may become a source of infection and lead to the formation of calcium bilirubinate stones as a result of the deconjugation of the bilirubin-glucoronide by glucorinidase producing bacteria, particularly E.coli. Thus, a closed system of drainage should always be used and a bile culture performed a few days before the

removal of the T- tube. A course of the appropriate antibiotic should be administered if the culture is positive.

CORRECTION OF DISORDERS OF COAGULATION

The most common disorder of coagulation encountered in patients with large bile duct obstruction is a prolonged prothrombin time due to the deficiency of Vitamin-K dependent factors. The intramuscular injection of Phytomenadione (10-20mg) will reverse the multifactorial clotting factors deficiency within 1-3 days. In severe hepatic disease, if the prothrombin time remains prolonged despite the above treatment, administration of fresh frozen plasma is necessary in the peri-operative period.

PREVENTION OF RENAL FAILURE

The association between post-operative renal failure and severe conjugated hyperbilirubinemia is well known but the underlying mechanism of the renal impairment is inadequately understood, although a reduced glomerular filtration is usually present. Irrespective of the exact cause of the renal damage, there is good evidence that adequate hydration and pre-operative induction of a natriuresis/diuresis reduces the incidence of renal failure after surgical intervention in jaundiced patients. It is current routine practice to administer intravenous fluids

(5% dextrose saline) for 12-24 hrs before surgery. This is followed by an osmotic diuretic (mannitol) or a loop diuretic (frusemide) administered intravenously at the time of induction of anaesthesia. All patients undergoing surgery should be catheterized and urine output measured hourly. Further administration of diuretics (mannitol or frusemide) is indicated if the urine output falls consistently below 40 ml/h(despite adequate hydration and normovolemia) during surgery and subsequently thereafter.

MANAGEMENT OF CBD STONES

The management of choledocholithiasis with or without cholangitis depends upon many variables which include:

1) Patients general and medical condition

2) Detection of stones in relation to cholecystectomy – prior, during or after cholecystectomy.

3) Experience of the surgeon

4) Availability and skill of endoscopists, interventional radiologists.

SURGICAL MANAGEMENT:

Open Surgical Management

While open cholecystectomy alone may be performed with little morbidity, and a mortality of less than 0.5%, the addition of an exploration of bile duct increases the morbidity and mortality by 3 to 7 times. This may be due to the

fact that the procedure is more often necessary in patients of advanced age and associated medical illness. In addition, the longer duration of the procedure and the presence of jaundice, cholangitis or pancreatitis in patients with CBD stones influence morbidity and mortality.

Indication for open CBD exploration

1) Palpable stones in the CBD.

2) Jaundice with cholangitis

3) A stone visualized at intraoperative cholangiography

4) USG evidence of CBD stones.

5) Patients with failed endoscopic or laparoscopic CBD stone removal attempt.

6) Patients in whom an open cholecystectomy is performed for different reasons such as suspicion of cancer, presence of a biliary enteric fistula, Mirrizi's syndrome, should have palpation of the CBD and operative cholangiogram performed. If common bile duct stones are visualized, open CBD exploration is mandatory. Palpation of the CBD is often underestimated but is the most reliable indicator for choledochotomy, having an accuracy of 98% if a stone is judged palpable.

Obstructive jaundice with fever and chills is indicator of either cholangitis or acute cholecystitis. If patients with acute cholecystitis are excluded, this triad will

be associated with choledocholithiasis in approximately 97%0f the patients. For the non jaundiced patient, per op cholangiography is with palpation of stones the most reliable determinant of the presence of CBD stones should be performed routinely at open cholecystectomy.

APPROACH TO THE CBD

1. Supraduodenal :

The common bile duct is exposed above the dudoneum and it is helpful to mobilize the second part of the duodenum (Kocher's maneuver). The choledochostomy is longitudinal so as not to compromise the blood supply to the duct. The site of the choledochostomy is close to the duodenum to allow choledochoduodenostomy if required and to leave the greater length of bile duct above the choledochostomy should it be necessary to repair a postoperative bile duct stricture. The choledochostomy is performed on the anterolateral surface of the CBD in between two stay suture for a length of 2 cm subsequent to a needle choledochostomy which confirm the anatomical entity as the CBD. The sample bile is sent for culture and sensitivity. The common hepatic duct, right hepatic duct and left hepatic duct are explored using Desjardin's forceps and calculi removed. If duct contains small stones or sludge, irrigation can be done using normal saline. At the end of the procedure, a Kehr's T tube of 14Fr is inserted into CBD. The tube should preferably be of latex so as to form a well organized tract from the CBD to

the outside. It should be brought out through the lower end of incision over CBD, the short limb trimmed to 1 cm, the long limb brought out through a stab incision in the flank and CBD closed securely over T tube with interrupted PDS sutures.

Advantages of T Tube Drainage

1) Decompression of the duct, in case of residual ductal obstruction.

2) Access for ductal imaging in the postoperative period.

3) Access for removal of residual common duct stones, should they be left after common bile duct exploration.

Postoperatively, the T – tube is allowed to drain freely into a sterile closed drainage bag. A T – tube cholangiogram is obtained on the ninth or tenth day after surgery, and if the duct is clear, the T – tube is clamped. Provided the patient does not develop any pain or discomfort, the tube can be removed after 24 hours of clamping it.

The only reliable method of confirming complete clearance of CBD is post exploratory T – tube cholangiography or choledochoscopy. Pitfalls of open CBD exploration include imaging the bile ducts, creating a false passage into the duodenum when probing the CBD, sepsis, failing to remove all of the biliary calculi.

2 Transduodenal

This is carried out as a part of biliary enteric Drainage procedure or when CBD stone are present with CBD diameter < 4 mm when supraduodenal exploration of CBD may have future risk of biliary stricture formation. It is further detailed under Biliary enteric drainage procedures.

3 Transcystic

CBD may be explored in a dilated cystic duct and avoids the need for T – tube drainage.

Billiary Enteric Drainage Procedure

Surgical biliary enteric drainage procedure must be considered in situations of:

1) Multiple stones

2) Incomplete removal of stones

3) Impacted distal bile duct stones.

4) Markedly dilated CBD.

5) Distal bile duct obstruction from tumour or stricture.

6) Re-occurrence after previous bile duct exploration.

The methods of surgical drainage include:

Transduodenal Sphincterotomy (TDS)

It is employed when the common duct is less than 1.5cm in diameter in a young,low risk patient with a solitary impacted ampullary stone. However in elderly and high-risk patient with dilated ducts, choledochoduodenostomy is the procedure of choice. The duodenum is kocherised completely and the ampulla is located by passing a biliary Fogarty catheter through the CBD into the duodenum. A longitudinal duodenotomy is made over the ampulla. The duodenal wall at 11O' clock is incised from the lip of the ampulla to a distance of 3 cm or the first transverse fold superior to the papilla. The duodenal mucosa and bile duct mucosa are approximated using fine absorbable sutures. The last suture must be placed at the apex to avoid duodenal leak. This procedure converts the ampulla into a wide stoma and hence incidence of retained stone is very less. The duodenotomy is closed transversely to prevent duodenal stenosis.

Complications

• Acute pancreatitis.

• Restenosis of papille.

• Leak from duodenotomy.

Choledochoduodenostomy

A dilated duct is the sine quo non for this procedure. It should not be performed with ducts less than 1.4cm in diameter and a duct narrower than 1.2 cm

is an absolute contraindication. The FUNNEL SYNDROME in which a distal bile duct stenosis is one of the most classic indication. Stomal patency is felt to be the most important factor for preventing both cholangitis and sump syndrome. Stoma of at least 14 mm, along with placing the anastomosis near the duodenum is important.This procedure is preferred because :

• The anastomosis between distal CBD and the adjacent duodenum is easily made.

• Danger of pancreatitis is absent.

• Long term results are good.

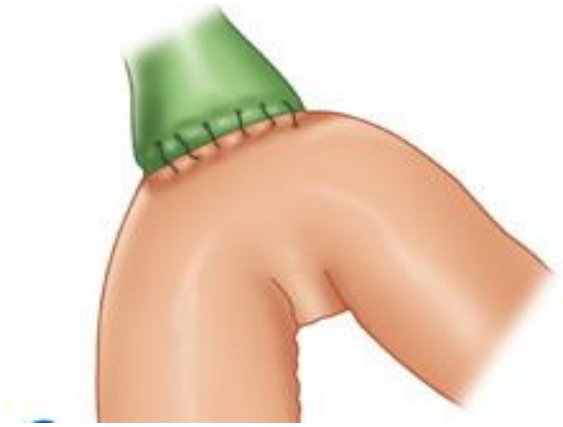
The choledochotomy is extended upto the duodenum for 2.5 cms. The duodenum is opened longitudinally for 1.5 cm along its superior border. A single layer absorbable interrupted suture in a side to side fashion are used to approximate CBD to duodenum. The knots shall be positioned outside, 2 mm apart. The anastomosis is started posteriorly - lower end of CBD opening to posterior lip of duodenotomy.

Complications

• Bile leak

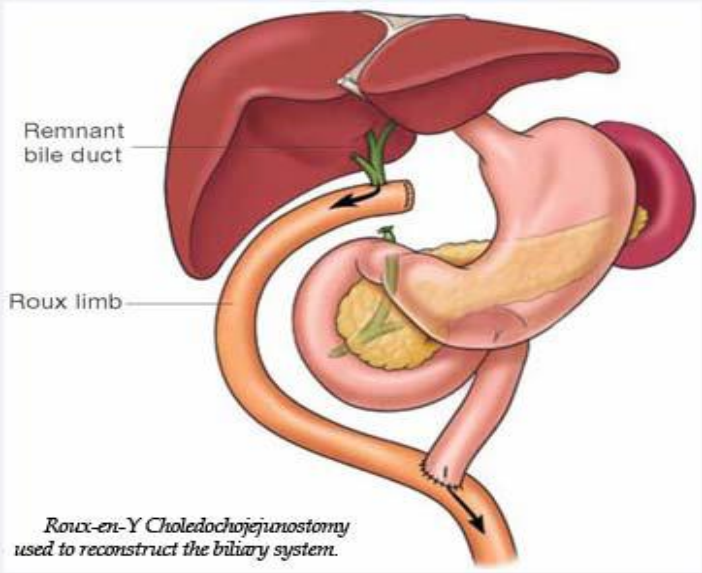
• Stricture at anastomiosis leading to cholangitis.

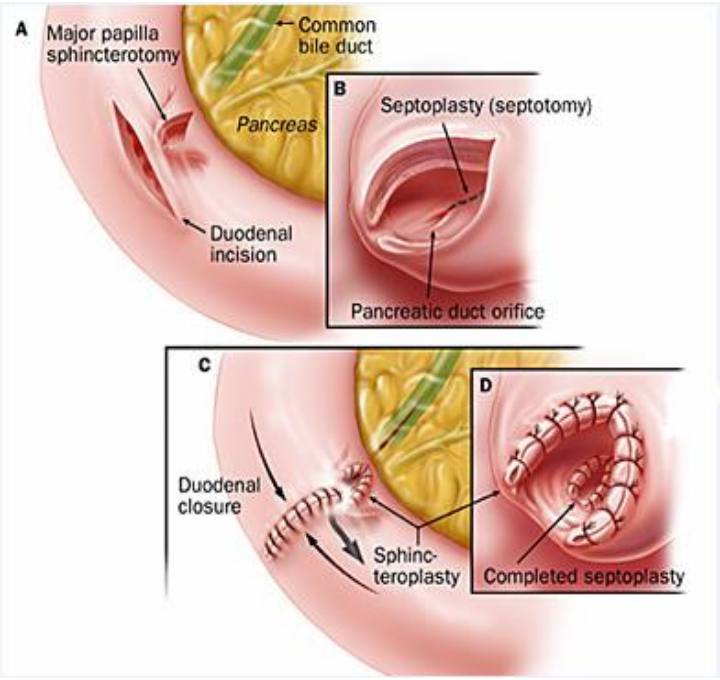
• Sump Syndrome- It is caused by food and debris accumulating between the stones and the papilla of vater. This leads to contamination of the large and small bile ducts with resulting recurrent cholangitis and even secondary biliary cirrhosis.



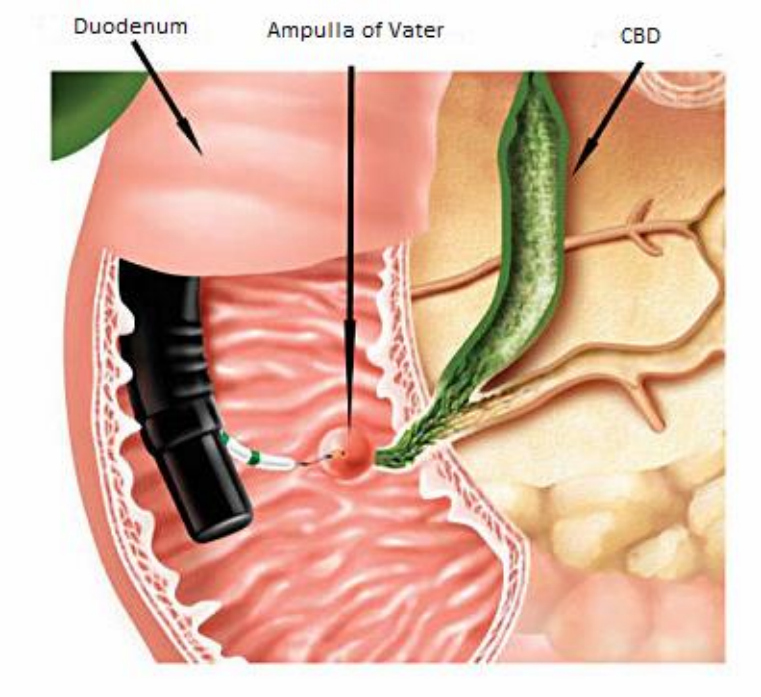
Choledochojejunostomy

It is an alternative to choledochoduodenostomy, can be done with either a loop or Roux – en Y configuration of Jejunum. The Roux en Y usually is brought retro colic using a 60 cm afferent limb to protect against intestinal reflux and secondary cholangitis. This procedure is used as an alternative to choledochoduodenostomy when the feasibility of creating a tension free anastomosis is low.





Transduodenal spincterotomy



Endoscopic spincterotomy

ENDOSCOPIC MANAGEMENT OF CBD STONES

In 1968 ERCP was introduced as a diagnostic tool to aid in the management of biliary and pancreatic disease48. Five years later, with development of endoscopic sphinctecotomy, ERCP was transformed into a therapeutic modality.

Indications

1) Acute cholangitis irrespective of gall bladder status.

2) Acute gall stone pancreatitis irrespective of gall bladder status.

3) Obstructive jaundice.

4) Post – cholecystectomy, stone(s) shown on intraoperative cholangiogram.

5) Post – cholecystectomy, retained stone(s), early presentation.

6) Post – cholecystectomy, late presentation.

7) Gall bladder in situ, variable risk factor for surgery, possible need for subsequent cholecystectomy.

Shortcomings Of The Endoscopic Approach

CBD is inadequately cleared of stones due to

a) Inability to cannulate the papilla.

- Duodenal stenosis
- Roux – en – Y reconstruction
- Billroth II Gastrectomy
- Periampullary diverticulum

b) Inability to extract stone after adequate sphincterotomy due to:

- Narrow lower bile duct segment
- Stone > 15 mm in size
- Intrahepatic stones
- Stone proximal to a stricture
- Very large number of stones
- Stone consistency – hard
- Stone shape – square

Technique of Endoscopic Management

ERCP stone extraction is successful 80% - 90% of time using the technique of sphincterotomy and balloon catheter or Dormia basket stone retrieval. The addition of mechanical, electrohydraulic, laser or intracorporeal shockwave Lithotripsy for large stones increases the success rate over 95%. The procedure is discussed under two headings below:

A. Access to the stone after selective bile duct cannulation

1) **Endoscopic Sphincterotomy (ES)**

Entails division of the papilla and sphincter muscles to widen distal end of CBD with an sphincterotome. The incision is vertical and in a cephalad direction from the papillary orifice for a length of 10 to 15 mm but not beyond the first transverse fold of duodenal mucosa cephalad to orifice in order to prevent perforation and hemorrhage. The size of incision depends upon local anatomy, degree of CBD dilation and size of stone to be removed.

2) **Balloon sphincteroplasty.**

This is a sphincter preserving alternative to sphicterotomy that uses a high pressure hydrostatic balloon of 6 to 8 mm diameter to dilate the papilla. One drawback is the limited size of the papillary opening created as compared with sphincterotomy. Sphincteroplasty has been associated with a pancreatitis rate of 19 times greater than the rate associated with sphicterotomy.

B Stone Retrieval. Most stones are retrieved using:

1) **Fogarty Balloon**: It is used for removal of small stones and gravel,intrahepatic stones.

2) **Dormia Basket: Stone** > 1 cm, where better traction is needed.

Three situations that may lead to difficult extraction of stones include – Stones > 1.5 cm, location proximal to a stricture, multiple impacted stones. In such situation additional retrieval techniques may have to be used.

1) **Mechanical Lithotripsy.** This is the most common and simplest means of fragmenting large bile duct stone or when a significant discrepancy between the stone size and the diameter of the exit passage exists. A large strong Dormia basket is used to trap the stone. The stone is then crushed
against a metal sheath by applying tension to the wires by the use of a crank handle. Success ranges from 90% for stones less than 1 cm to 68% for stones greater than 2.8 cm52. Impaction of the stone in the bile duct was found to be the only significant factor that predicted failure of Mechanical Lithotripsy.

2) **Intraductal Shockwave Lithotripsy.**

It is used when Mechanical Lithotripsy fails. It is performed using a cholangioscope that is inserted into the bile duct through the instrument channel of the duodenoscope – based on a 'Mother – baby scope' system. A flexible Lithotripsy probe then is passed into the bile duct through the working channel of

the cholangioscope. Shock waves are generated at the tip of the Lithotripsy probe using electrical (Electrohydraulic Lithotripsy) or light energy (Laser lithotripsy).53Impulses are fired on the surface of the stones under cholangioscopic guidance until the needed fragmentation is achieved. The main risk of intraductal shock wave therapy is bile duct injury resulting from a misguided shock wave. The avoidance of this complications makes cholangiascopic guidance necessary.

3) **Endoprosthesis Placement**.

In a few situations where stone extraction is incomplete or impossible because of stone size, local anatomy, bleeding or technical difficulty leading to incomplete ES, a nasobiliary tube or endoprosthesis is inserted to provide biliary decompression and prevent stone impaction in the distal CBD. This serves as a temporizing therapy allowing for improvement in the patient's clinical condition until complete stone clearance is achieved either via additional endoscopic maneuvers or surgery.

Complications of ERCP

1) **Pancreatitis**: It is the most common complication. The definition for ERCP induced pancreatitis is:

• New or worsened abdominal pain.

• Serum amylase – 2 or more times the upper limit of normal 24 hrs after the procedure.

• Requirement of at least 2 days of hospitalization.

Risk factors for ERCP pancreatitis include

1) Non-dilated biliary ducts, normal bilurubin, young age, female gender, suspected sphincter of Oddi dysfunction.

2) Perforation of the duodenum.

3) Bleeding.

4) Cholecystitis

5) Cholangitis.

INTERVENTIONAL RADIOLOGY MANAGEMENT OF CBD STONES

Radiology of the biliary tract owes its beginning to contribution from surgery with the original description of transhepatic gall bladder puncture in 921,cholecystography in 1923 and post surgical cholangiography in 1924 .

Access to the Biliary Tract :

1) Post operative sinus track

• T – tube track

• Cholecystotomy tube track

2) Percutaneously via transhepatic route.

T- Tube track access:

Instrumentation of a T – tube tract is an easy technical procedure and has implication for surgical T – tube placement. Precautions to be taken while inserting T – tube include :

- The caliber of T – tube should be at least 14 fr.
- The T tube should exit through a stab wound in the right flank in the anterior axilliary line. Anterior T – tube tracks should not be made because instrumentation is difficult and the operator hands come into field of radiation.
- Latex T – tube should be used as silicon T – tube cause inadequate inflammatory reaction and hence poor sinus track formation.
- At least a total of 5 weeks should elapse for fibrous tract formation for stone extraction Obese, immunosuppressed, T –tube <14 Fr may require more than 5 weeks interval.

Transhepatic Route.

This approach is used as a last resort when a postoperative drainage tract is not available, when surgical or endoscopic stone removal is contraindicated or not possible. This is an adaptation of percutaneous transhepatic cholangiography .

Cholecystostomy Tract.

5 week waiting period after surgical cholecystostomy is needed before instrumentation. The CBD is entered through cystic duct. If deliberate cholecystostomy is performed, in the high risk patient with CBD stones,then the fundus can be sutured to the peritoneum of anterolateral abdominal wall.By this instrumentation can be done within 1 week.

Technique of CBD stone extraction:

Done under conscious sedation. The T-tube is removed and a steerable catheter is maneuvered along side the stone. The basket is opened and stone ensnared through the T-tube track. This is done under fluoroscopic guidance. A 6-7mm stone can be removed through a 14 fr T-tube.Larger stones need to be fragmented using mechanical or laser lithotripsy.

Results:

The success rate of radiolological percutaneous stone extraction therapy through T-tube using basket is 88 to 97%56.The reasons for failure were:

1) Intrahepatic stones(50% of all cases)

2) Impacted distal CBD stones.

3) Inability to cathterise the tract due to a small T-tube tract.

4) Tortous T-tube tract.

5) Inability to fragment large stone(>7mm)

Complications:

• Sinus tract perforation

• Bile leak

• Cholangitis

• Pancreatitis

LAPROSCOPIC APPROACH TO CBD STONES:

The treatment of CBD stones was relatively straight forward until the advent of laproscopic cholecystectomy in 1989. Laproscopic exploration of the CBD enables appropriate patients to undergo complete management of the calculous biliary tact disease with one invasive procedure.This modality of treatment is ideal for patients with CBD stones identified during intra op cholangiography or in patients with preop suspected suspected CBD stone managed at centers where laproscopic CBD explorations are routinely performed.There are two approaches for Laproscopic CBD exploration:Transcystic duct bile duct exploration and Laproscopic choledochotomy.

Laproscopic Transcystic duct bile duct exploration:

This technique involves blunt dissection of the cystic duct down to its junction with the CBD.A cystic ductomy is made and a guide wire inserted into the bile duct. A cholangiocatheter can then be advanced over the guide wire into the

bile duct and saline irrigated through the catheter in an attempt to flush small stones out of the bile duct .If the stones are larger than the lumen of the cystic duct ;cystic duct is dilated with a balloon catheter. Stone retrieval baskets can then be inserted to extract stones under fluoroscopy. To document stone clearance a completion cholangiogram should be performed. A cystic duct drainage tube can be left in place if there are equivocal findings on cholagiogram. Later radiological extraction of the retained stones through the tract can be done.

Laproscopic Choledochotomy:

A longitudinal choledochotomy is made on the anterior wall below the cystic duct. The choledochotomy should be as long as the diameter of the largest stone.Stones are extracted using baskets or balloon. Choledochotomy is then closed over 4-O PDS sutures. This procedure requires skill to close the choledochostomy.

Clearance of all CBD stones is achieved in 75% to 95% of patients with laproscopic CBD exploration.Complications of lap CBD exploration include: Biliary leak, disloged T-tube,biliary sticture, subhepatic fluid collection and damage to surrounding viscera.

3.METHODOLOGY

The present study was carried out in patients with obstructive jaundice due to choledocholithiasis between June 2011 to December 2013 in Rajiv Gandhi Government General hospital attached to Madras Medical College.

Totally 50 patients with jaundice due to choledocholithiasis were included in the study. All the 50 patients were treated with either ERCP or with open surgery. Outcome of both the procedures were compared.

Types of outcome measures

1. Mortality at 30 days and at maximum follow-up.

2.Morbidity- Complications from surgery and procedures such as bile duct injuries, pancreatitis, cholangitis, pulmonary/cardiac/ renal complications.

3.Duct clearance as determined by cholangiogram at the time of intervention, lack of symptoms, signs or abnormal biochemistry/ liver function tests.

4.Number of procedures.

5. Duration of operation and/or procedure(s).

6.Duration of hospital stay.

All the above measures were compared between the two groups.

Detailed clinical history and examination were performed in all cases as per the proforma. Diagnostic investigations – ultrasonography abdomen, LFT were done in all cases. Perop cholangiogram was selectively used when USG was

negative for CBD stones, but history and biochemical parameters were suggestive of CBD stones.

Procedural investigations like Hb%, coagulation profile, TC, DC, RBS, Blood urea, serum creatinine, chest X ray and ECG were performed in all cases. Bile cultures were obtained in all cases.

INCLUSION CRITERIA:

1.All the cases of Common bile duct stones

2. CBD stones complicating as obstructive jaundice, cholangitis, pancreatitis.

EXCLUSION CRITERIA:

1. Patients with ductal obstruction due to malignant diseases.

All patients were screened for any coagulopathy and treated appropriately with Vitamin K or fresh frozen plasma depending upon the severity and urgency of the procedure.Pre op vitamin K was given to all patients. All patients were adequately hydrated and flushed with mannitol to prevent hepatorenal syndrome.

For open surgery with T-tube closure; discharge was done after the 10th day T-tube cholangiogram was negative for stones and dye in the duodenum was present. Patients with biliary enteric anastomosis were discharged when they were taking oral diet, feeling symptomatically better and the suture wound had healed.Some patients with surgical site infection had extended stay till the surgical wound was dry and healing. Patients who had undergone ERCP were discharged

when symptomatically better and taking oral diet .

Closed suction drains were used in all open and laparoscopic CBD exploration cases. It was kept in subhepatic space and removed after 48 hrs or when the collection was non bilious and less than 30 ml in 12 hrs.All patients were followed up on out patient basis with repeated assessment of patients' symptomatic status, physical exam, liver function tests and abdominal ultrasonography. The interval of follow was 1 week, 2 weeks, 1 month, 2 months,6 months, 12 months, 18 months and 24 months.

Statistical analysis in the form of percentages, means, confidence intervals,standard deviations, sensitivity, specificity, positive predictive value were calculated to analyze the significance of the diagnostic investigations and the impact of the therapeutic procedures. The statistical software SPSS 11.0 was used for analysis of data, Microsoft word and Excel were used to generate graphs and tables.

5. RESULTS

TABLE 1

Age distribution with gender

Age in years	Male	Female	Total
<30	3(6%)	2(4%)	5(10%)
30-40	2(4%)	4(8%)	6(12%)
40-50	5(10%)	9(18%)	14(28%)
50-60	5(10%)	10(20%)	15(30%)
>60	4(8%)	6(12%)	10(20%)
Total	19(38%)	31(62%)	50(100%)
Mean	47.84	54.76	51.30

Age at incidence:

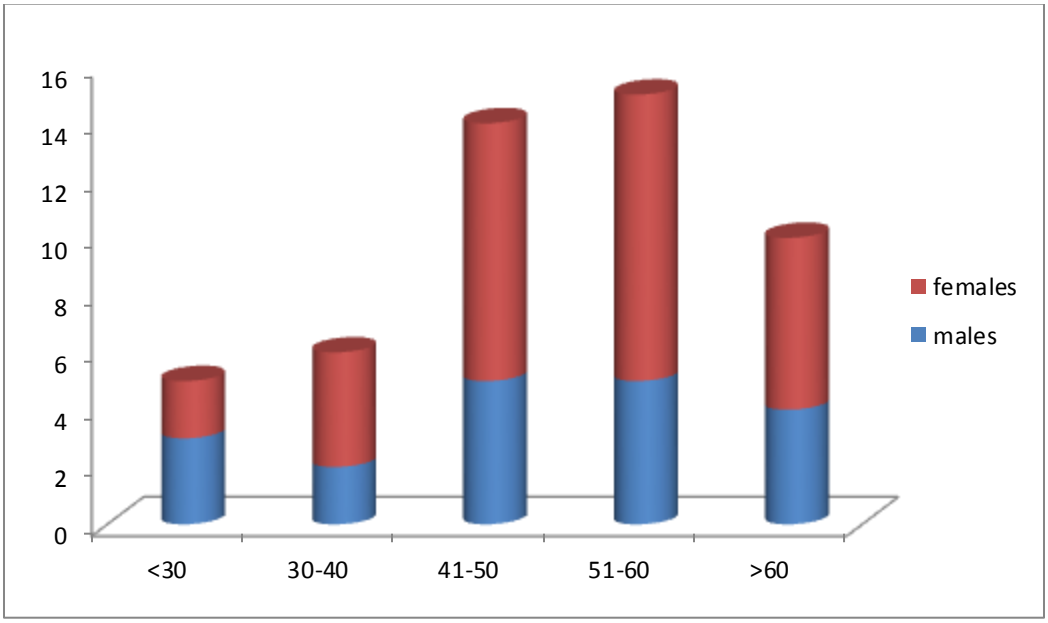
Age of the patients varied from 21 t0 74 years. Mean age for male was 47.84 years and female was 54.76 years. Mean age was 51.30 years. Highest incidence was noted in the age group between 50 and 60 years and lowest incidence less than 30 years.

Sex incidence:

Out of the 50 patients 19(38%) were males and 31(62%) were females.

GRAPH 1

Age incidence



Age in years

GRAPH 2

Male /Female ratio

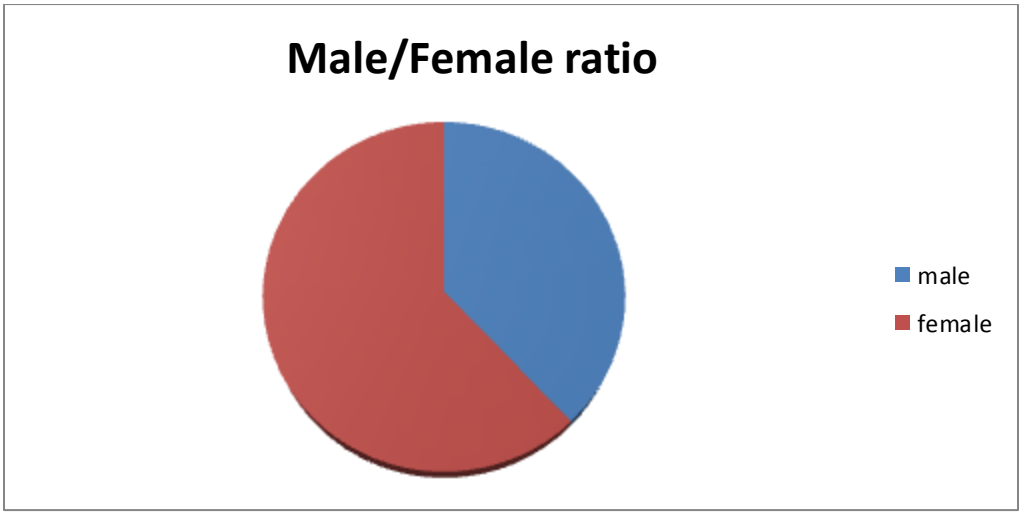


TABLE 2

Incidence of CBD Stone in Relation to GB Stone Incidence.

Type of stone	Number of cases
GB stone	784
CBD stone	50

CBD Stone patients as a % of GB Stone patients - 6.37%

GRAPH 3

Incidence of CBD Stone in Relation to GB Stone Incidence.

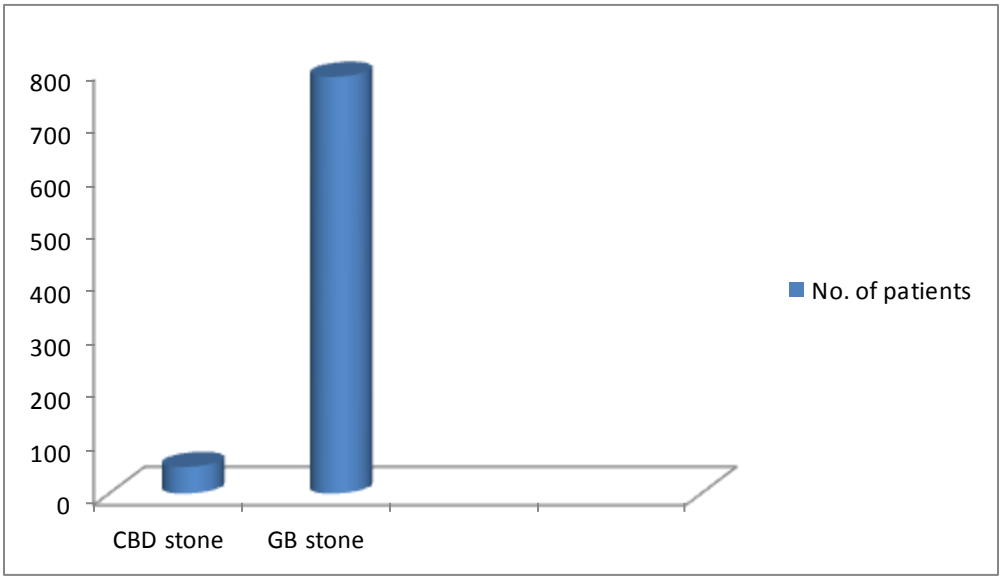


TABLE 3

Duration of Hospital stay.

Duration of hospital stay in days	Number n=50	%
1 to 7	-	
8 to 14	15	30
15 to 21	26	52
>21	9	18
Mean = 18.3 days		

Duration of Hospital Stay:

15 patients (30%) stayed in the hospital for a duration ranging from 8 to 14 days. 26 patients (52%) stayed for a period of 15 to 21 days, 9patients stayed or more than 21 days and no patient was discharged prior to 7 days of admission.

GRAPH 4

Duration of Hospital stay.

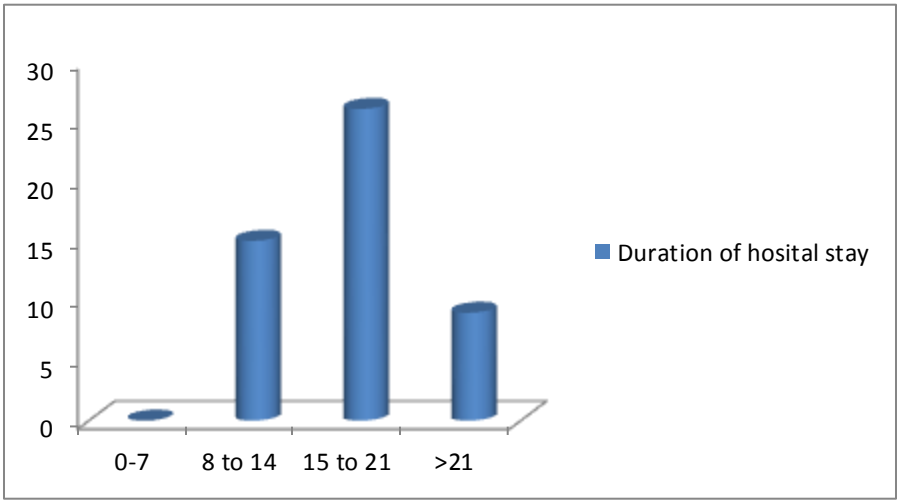


TABLE 4

Presenting symptoms

Presenting symptom	Number n=50	%
Pain	44	88
Jaundice	30	60
Fever	7	16
Pancreatitis	2	4

Presenting Symptoms.

Pain abdomen was present in 44 patients(88%). Severe pain abdomen radiating to the back, suggesting pancreatitis was present in 2 patients (4). Jaundice was present in 30 patients(60%) and Fever was present in 7patients (14%).

GRAPH 5

Presenting symptoms

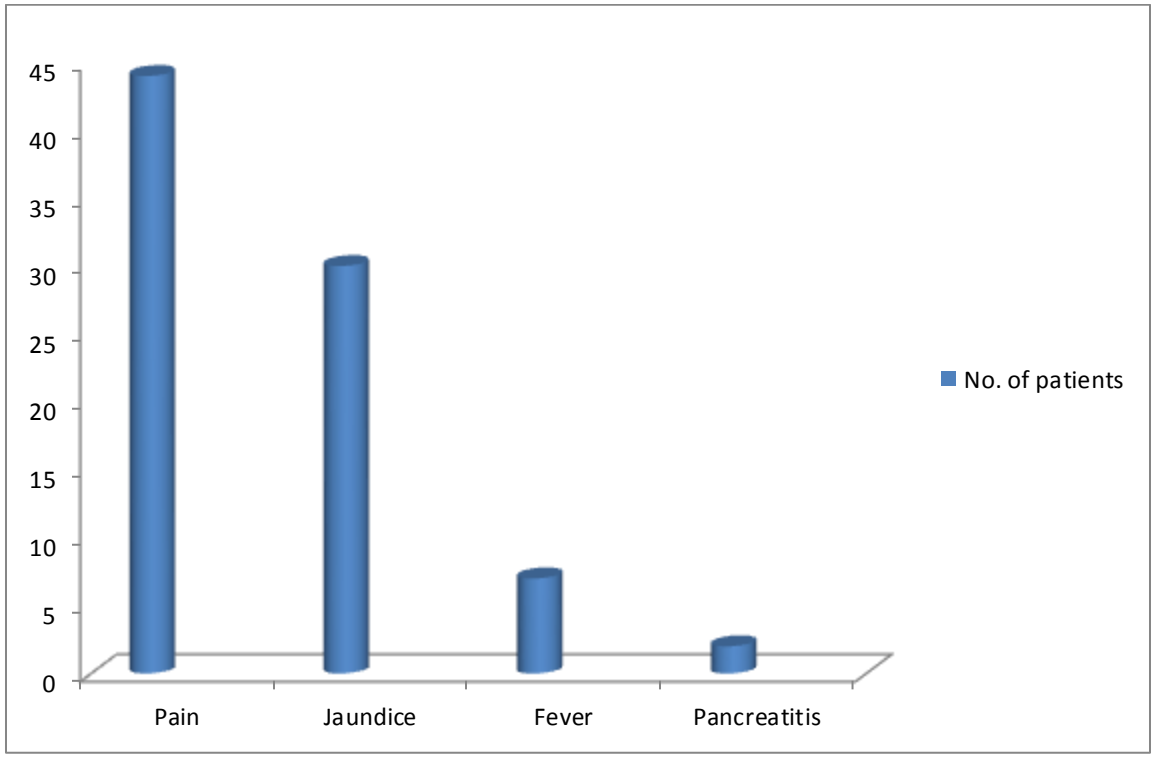


TABLE 5

Past History

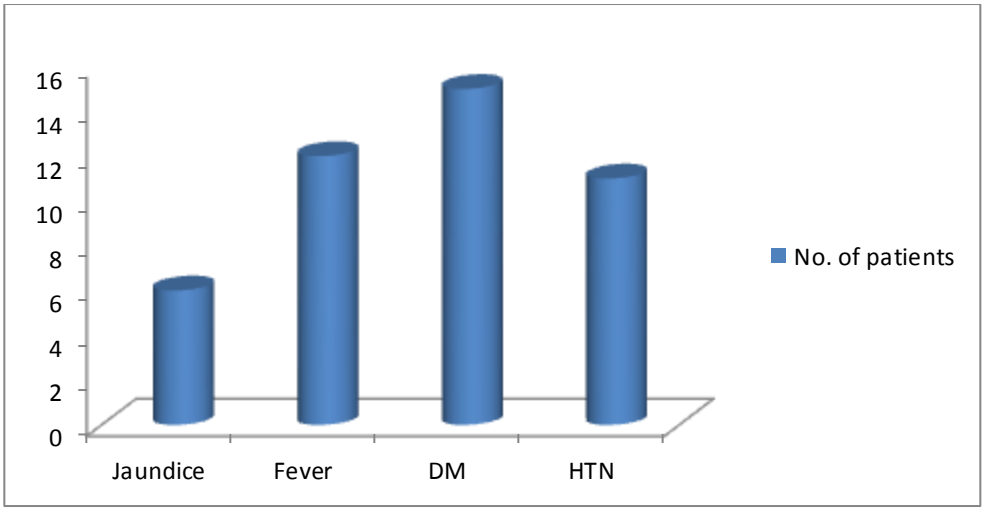
Past History	Number n=50	%
Jaundice	6	12
Fever	12	24
DM	15	30
HTN	11	22

Past History.

6 patients (12%) had documented past history of jaundice, relieved by temporary biliary stent before inclusion in our study. 12 patients (24%)) had recurrent attacks of fever with chills and rigors, suggestive of cholangitis. The most common co-morbid medical illness was DM (30%) followed by HTN (22%)

GRAPH 6

Past History



LAB FINDINGS

TABLE 6

Total Biluribin

Total Bilirubin(mg%)	Number n=50	%
≤ 1	8	16
>1 - 2	7	14
>2 - 4	15	30
>4-6	9	18
>6	11	22

Mean = 3.86 mg%; SD = 1.7026

35(70%) patients had clinical evidence of jaundice (icterus) because their total bilirubin values exceeded the clinical threshold of 2 mg%.Most of the patients had values between 2 to 4 mg% with highest value obtained of 15.6mg%.

GRAPH 7

Total bilirubin

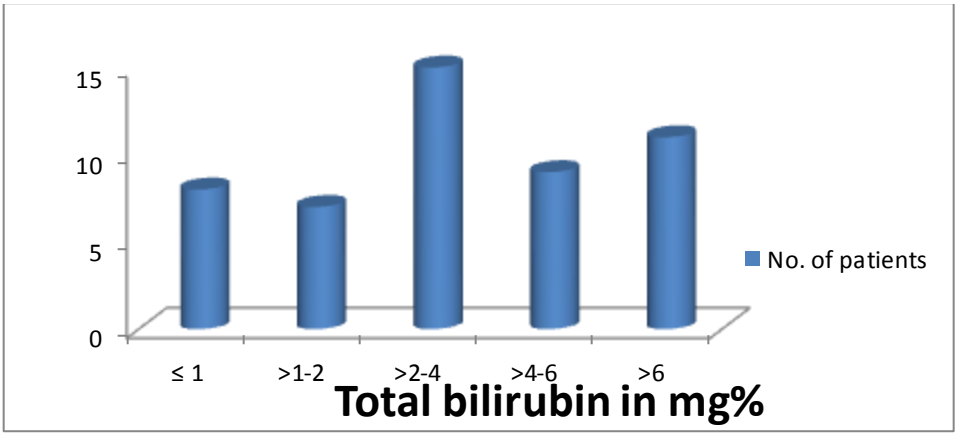


TABLE 7

Conjugate Biluribin

Conjugate Biluribin mg%	Number n=50	%
0.3 – 1	8	16
>1-3	17	34
>3-5	13	26
>5	12	24

Mean = 2.054 mg%; SD = 1.04

The mean conjugate bilirubin obtained was 2.054mg%. Most of the patients had values ranging from 1 to 3 mg%.

GRAPH 8

Conjugated Bilirubin

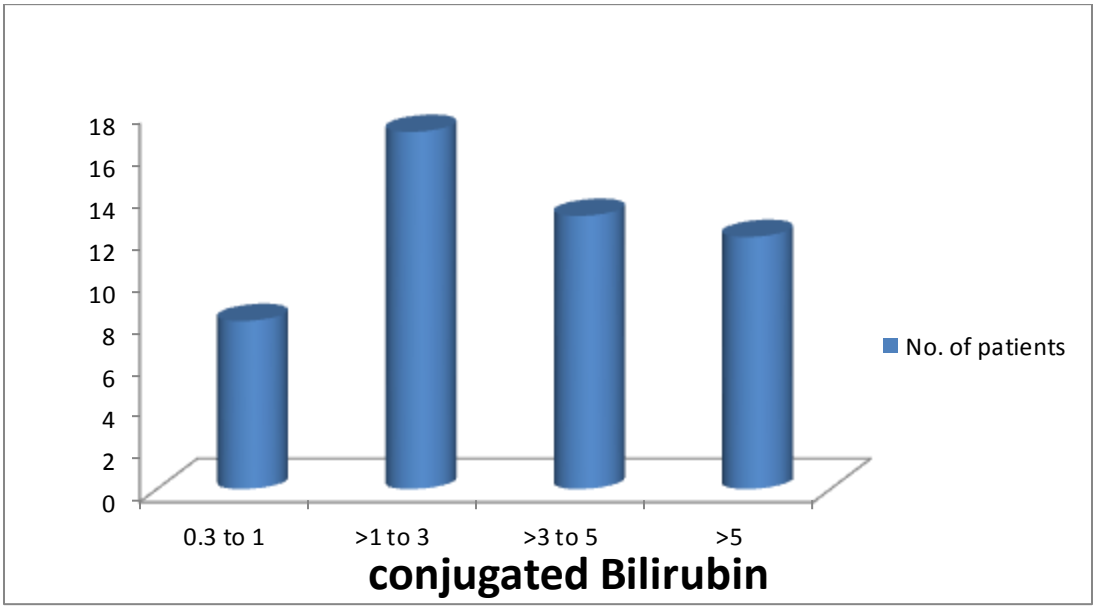


TABLE 8

Alkaline Phosphatase

Alkaline phosphate IU/L	Number n=50	%
130 to 150	7	14
>150 to 250	19	38
>250 to 350	8	16
>350 to 450	7	14
>450 to 550	6	12
>550	3	6

Mean = 273.2 IU/L; SD = 121

All patients had raised alkaline phosphatase. Even in 7 cases (14%)where total bilirubin was normal, alkaline phosphatase was raised, suggesting cholestasis. Mean alkaline phosphatase was 273.2 IU/L. Most patients had values between 151 to 250 IU/L.

GRAPH 9

Level of Blood Alkaline Phosphate in IU/L

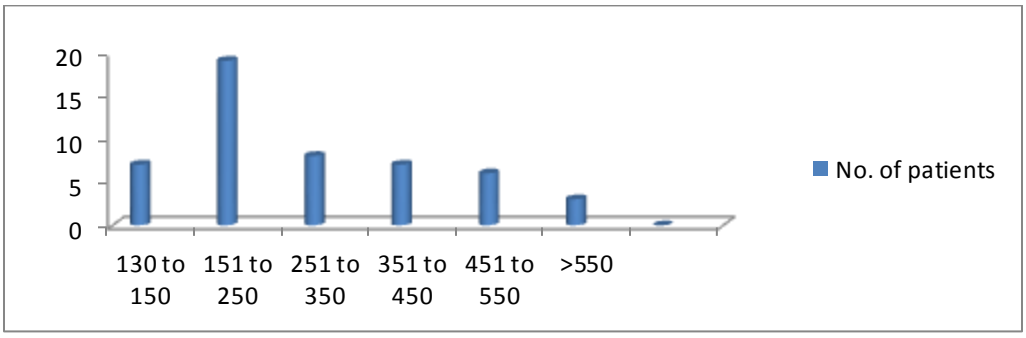


TABLE 9

Ultrasonography Abdomen – Gall Bladder

Findings	Number n=50	%
Normal GB	3	6
Wall thickening	44	88
Stones	43	86
Sludge	2	4
No Gall Bladder	3	6
Dilatation of IHBR	36	72

44 patients (88%) had thickened/contracted gall bladder suggestive of chronic cholecystitis. Similarly either sludge or stones were present in 45 patients(90%).3 patients(6%) had a sonologically normal gall bladder with CBD stones which was later confirmed to be primary CBD stones.3 patients (6%) had undergone cholecystectomy earlier.

GRAPH 10

Ultrasonography of abdomen : Gall Bladder

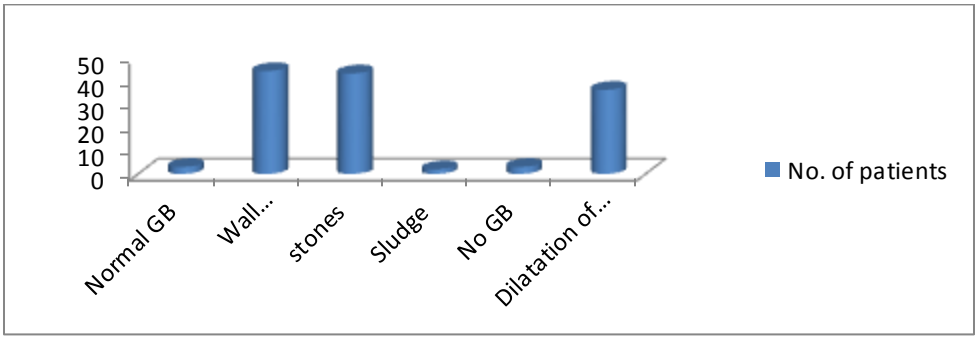


TABLE 10

Ultrasonography of abdomen- CBD Diameter

CBD diameter in mm	Number n=50	%
≥ 8 to <10	9	18
10 to <12	14	28
12 to <14	7	14
14 to < 16	11	22
16 to <18	4	8
18 to <20	3	6
≥20	2	4

Mean = 15.32; SD = 4.86

The mean CBD diameter was 15.32 mm with most patients having CBD diameter either between 10 to 12 mm(28%).The highest recorded CBD diameter was 25mm.

GRAPH 11

CBD Diameter in mm

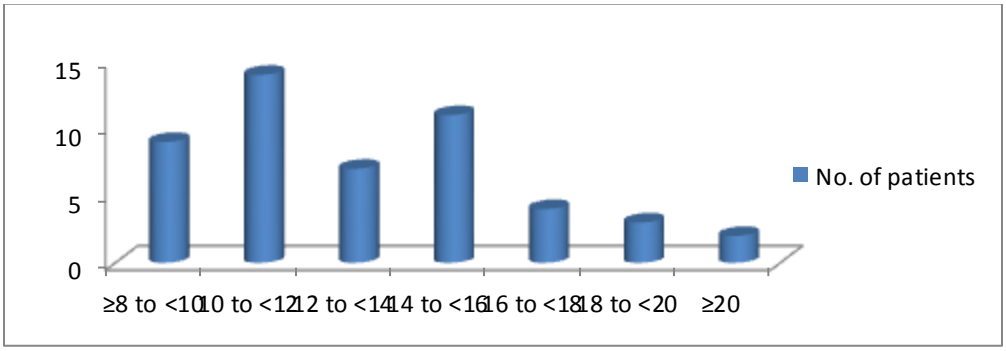


TABLE 11

CBD Calculi as in Ultrasonography of abdomen

Stones	Number n=50	%
Multiple	36	72
Single	8	16
False Negative	3	6
Sludge	3	6

44 patients(88%) had sonological evidence of stones in the CBD. 3(6 %) cases had false negative sonology of the CBD for stones which was confirmed with per op cholangiogram in 2 cases and by MRCP in one case.

GRAPH 12

CBD calculi

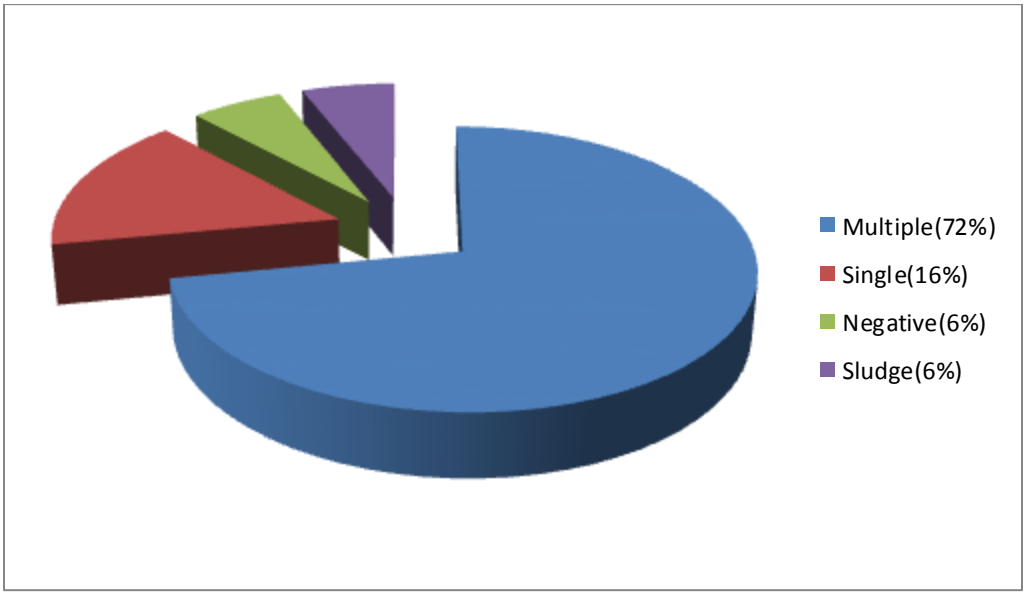


TABLE 12

Bile Culture

Bile culture	Number n=50	%
E.coli	32	64
Klebsiella	9	18
Enterococcus faeclis	3	6
No growth	6	12

Most common organism isolated was E.coli (64%) cases. 6patients (12%) had no evidence of any growth despite of culturing for 48 hrs on both aerobic and anaerobic culture media. Klebsiella was grown in about 9 patients (18%).

GRAPH 13

Bile Culture

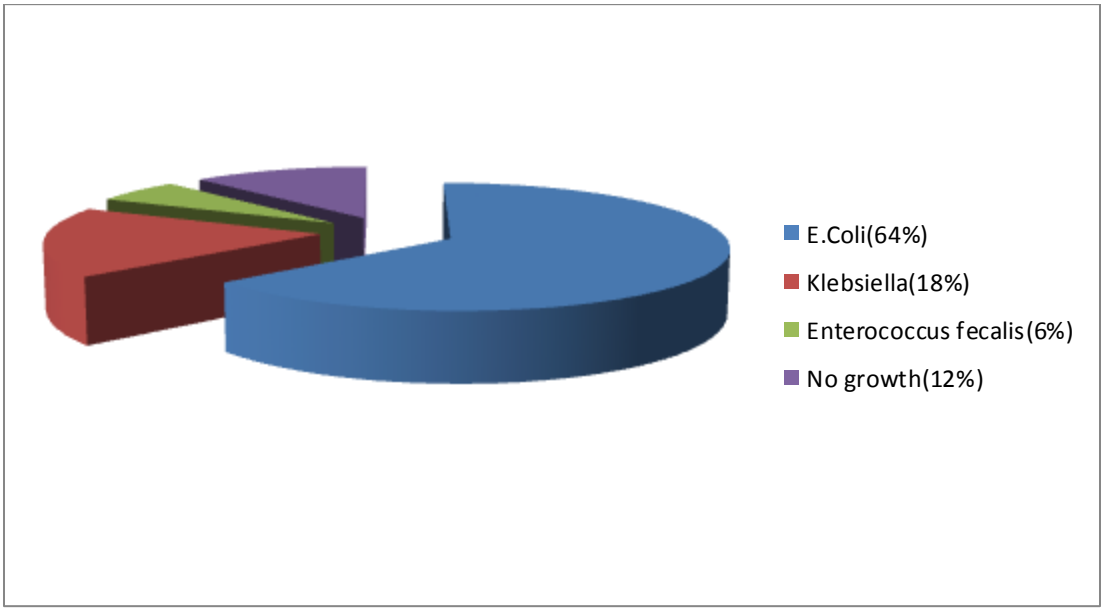


TABLE 13

Per Op Cholangiogram

Pre Clearance Per Op Cholangiogram	Number n=3	%
Stones visualised	3	100
Stones not visualised	0	-
Specificity		100

Post Clearance Per Op Cholangiogram	Number n=6	%
Filling defect(stone)	0	0
Flow into duodenum	5	83.33%
Specificity		83.33%

Per op cholangiogram was used in 3 cases with negative USG for CBD stones and had specificity of 100%.However per op cholangiogram was false positive in 1 case in post exploration cholangiogram bringing its specificity to 83.33% in this scenario.

TABLE 14

ERCP

Result	Number n=16	%
Stone visualisation	16	100
Successful clearance	11	68.75
Incomplete clearance when stent in situ	5	31.25
Post ERCP pancreatitis	2	12.5

ERCP had success of clearing the CBD of all the stones in 68.75% of the cases. It failed in 5 cases (31.25%) for which a temporary stent was left followed by open CBD exploration.2 patients(12.5%) developed post ERCP pancreatitis.

GRAPH 14

ERCP

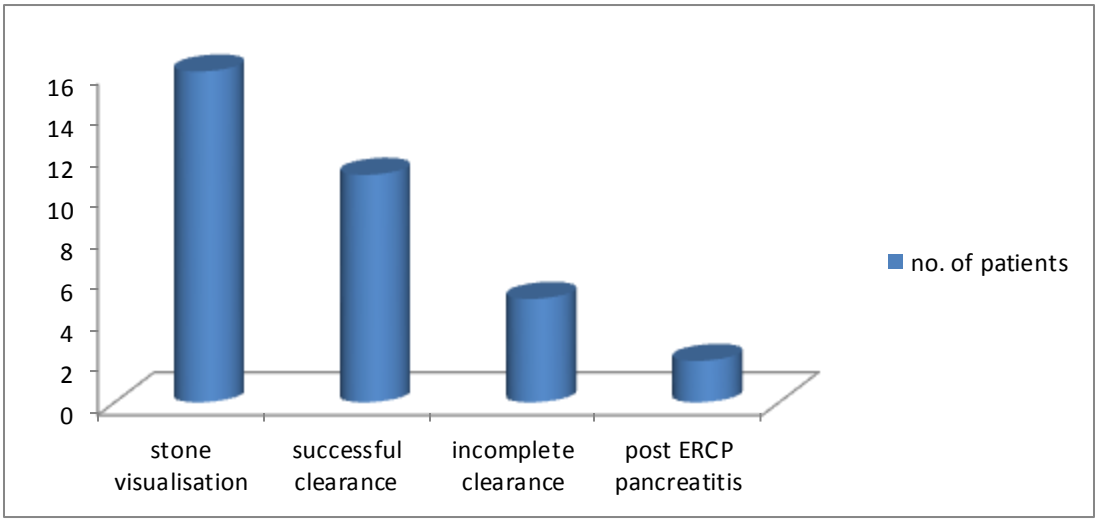


TABLE 15

Open Surgery

Procedure	Number n=39	%
CBDE+ T- Tube closure	34	87.18
CBDE+ choledochoduodenostomy	4	10.26
CBDE+choledochojejunostomy	1	2.56
Hepaticojejunostomy	-	-

39 patients were subjected to open CBD exploration which also include 5 failed cases of ERCP. 34 patients (87.18%) underwent CBDE with T-tube closure. 4 patients (10.26%) underwent choledochoduodenostomy . 1 case(2.56%) underwent choledochojejunostomy as the patient had a scarred duodenum from acid peptic disease and had undergone Gastrojejunostomy earlier.

GRAPH 15

OPEN SURGERY

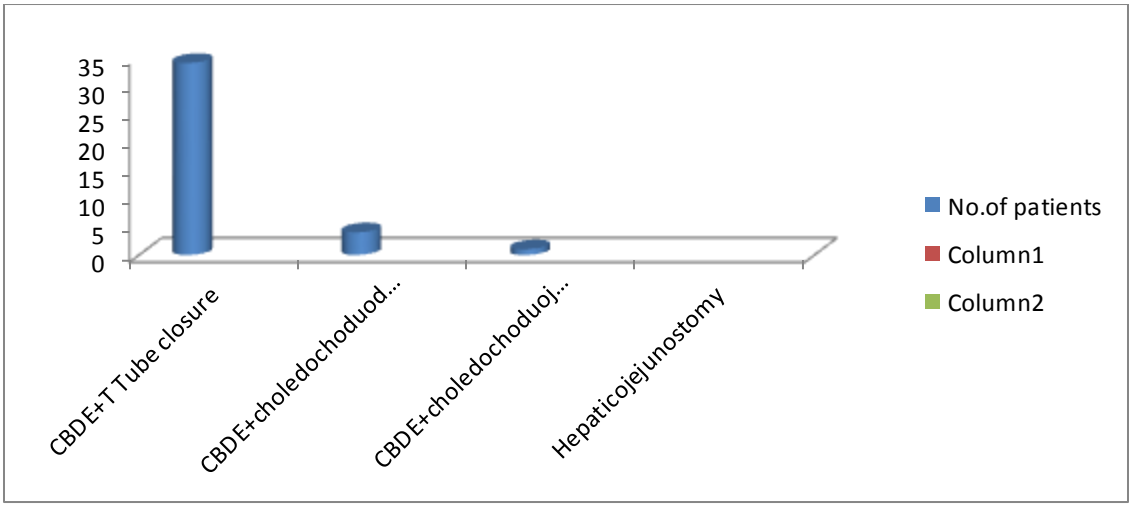


TABLE 16

Complications of open surgery

Complication	Number n=39	%
SSI	7	17.94
Bile leak	1	2.56
LRTI	4	10.25
Retained stone	0	0

Mortality- 0% Morbidity- 30.75%

7 patients (17.94%) developed infection of surgical wound as a result of contamination from the biliary tract. Bile leak was seen in 1patient (2.56%) due to T-tube dislodgement. 4 patients (10.25%) developed lower respitory tract infection (LRTI).

TABLE 17

FOLLOW UP

Duration (months)	Number n=50	%
Till date	34	68
Upto 24 months	0	0
Upto 18 months	2	4
Upto 12 months	4	8
Upto 6 months	3	6
Upto 2 months	2	4
Lost after discharge	5	10

68 % (34 patients) have been followed up till the time of submission of this study. 14% (7 cases) were lost from follow up after 2 months of surgery.

GRAPH 17

FOLLOW UP

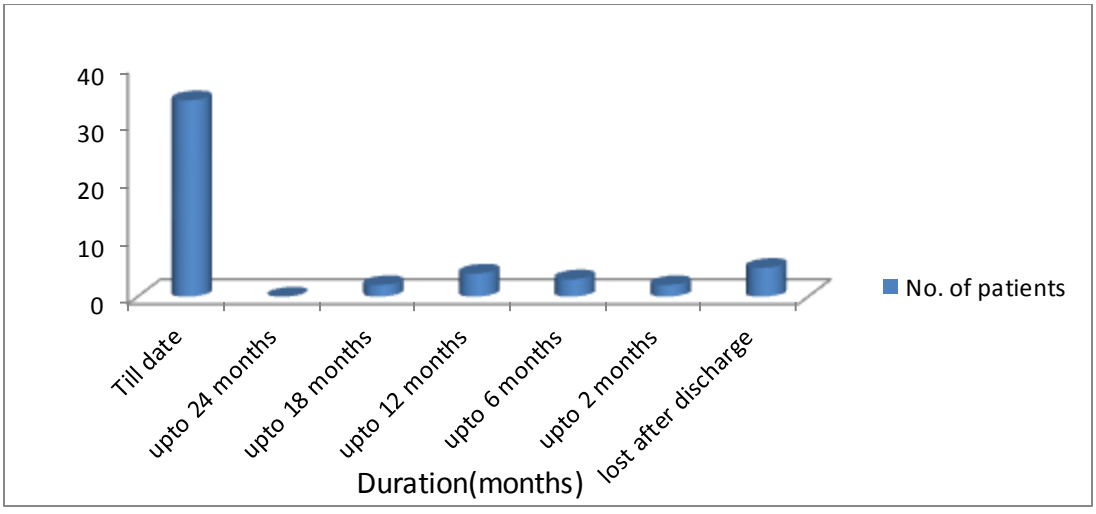


TABLE 18

OVERALL MORBIDITY

Morbidity	%
Open Surgery	30.57
ERCP	12.5
Mortality	0

While mortality is nil in both open and ERCP procedures the post operative morbidity of open procedure was more when compared to ERCP.

TABLE 19

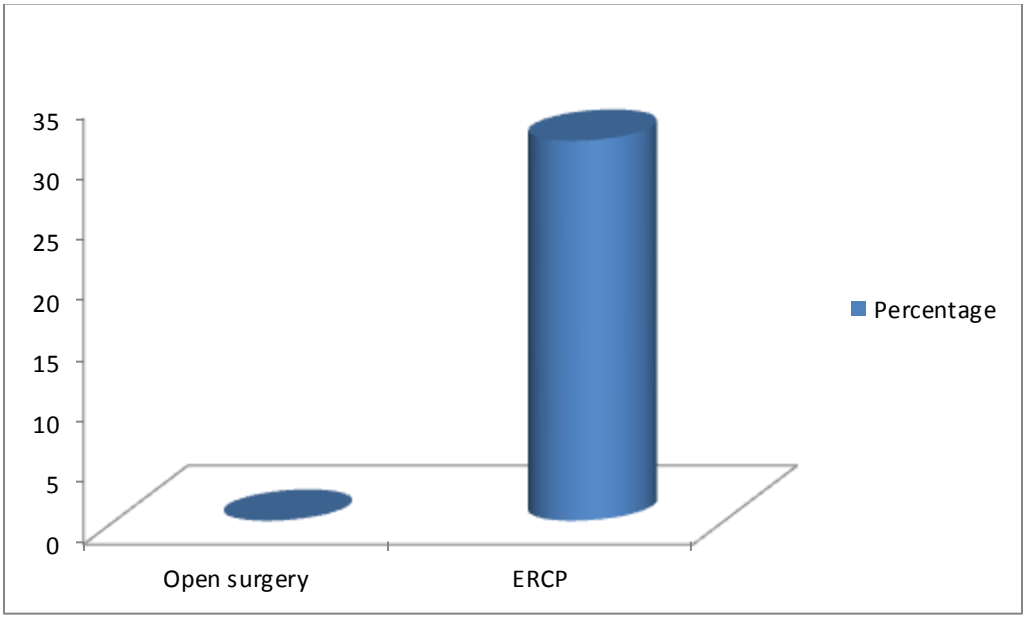
FAILIURE RATE

Procedure	Number of cases	%
Open surgery	0	0
ERCP	5	31.25

Out of 16 patients who had undergone ERCP, incomplete clearance of the CBD or retained stones found in 5 patients (31.25%) . These patients had undergone open surgery after ERCP for complete clearance of the duct.

GRAPH 18

FAILIURE RATE



5.DISCUSSION

Common bile duct stones are present in approximately 5% of patients undergoing elective cholecystectomy and 10% of patients with acute cholecystitis. No single blood investigation or combination of blood investigations can predict whether or not a common bile duct stone is present.

Intraoperative cholangiography is the gold standard of diagnosis but CBD stone can be diagnosed preoperatively with ultrasound, ERCP, or magnetic resonance cholangiopancreatography.If choledocholithiasis is diagnosed preoperatively, several different modalities can be utilized. The factor that determine the optimal approach include patient's age and condition, the presence of jaundice or cholangitis and size of the duct and stone.Hence, algorithm for managing these patients will vary from one locale to another. There are specific conditions that mandate CBD open exploration and therefore the practicing surgeon must be well versed in those techniques.

The natural history of choledocholithiasis is unpredictable. Small stones may pass spontaneously into the duodenum without causing symptoms, or they may obstruct the pancreatic duct temporarily, induce an episode of pancreatitis, and pass into the duodenum with relief of symptoms. Stones that do not pass into the duodenum may reside in the bile duct for long, symptom free periods, then suddenly precipitate an episode of jaundice or cholangitis .

The study was conducted in the Department of General Surgery under madras Medical College . We have the essential infrastructure for open surgical management for CBD stones and endoscopic infrastructure. Through this study, it was aimed to describe the disease and develop a management protocol for patients with CBD stones in our setting. The present study has been carried out on patients who were admitted with CBD stones in Rajiv Gandhi Government General Hospital, Chennai from June 2011 to December 2013. Detailed clinical history and examinations were performed in all cases. Diagnosis of CBD stone causing jaundice was arrived at on the basis of abdominal ultrasonography and blood investigations. Selected cases were subjected to per operative cholangiography and ERCP based on their merit. Patients underwent relevant blood investigations – Hemoglobin, TC, DC, RBS, blood urea, Serum createnine, Liver function test. Patients with abnormal bleeding, clotting time were subject to further evaluation using PT, aPTT. Bile culture and sensitivity were done for all cases.

Protocol was followed and patients were followed up, complications were studied.

Incidence of Disease

During the study period, 784 cases of documented cholelithiasis were admitted out of these 50 had evidence of common bile duct stones. Thus incidence of CBD stone in milieu of cholelithiasis was 6.37%.

According to Gerard, the overall incidence of CBD stones was 8% of the cases with cholelithiasis.

Age Incidence

Age of the patients varied from 21 to 74 yrs. Mean age for male was 47.84 years and female was 54.76 years. Mean age was 51.30 years. Highest incidence was noted in the age group between 50 and 60 years and lowest incidence less than 30 years.

In the study conducted by Gerard RM 61 (2000) maximum incidence was seen in age group between 50 – 59 yrs (20.1%).

Sex incidence

The female to male ratio was 1.6. According to Gerard RM 61 (2000), the female to male ratio was 1.72.

Duration of Hospital Stay

Mean duration of stay was 18.3 days. This was because of choledochotomy closure in all except cases which underwent complete stone clearance by ERCP or biliary enteric drainage were done on a T-tube. According to

Marwahs et al (2004) mean hospital stay was 4.4 days with primary choledochotomy closure and 15.4 days with closure on T – tube.

Presenting Symptoms

Pain was the most common symptom. Pain abdomen was present in 44 patients(88%). Severe pain abdomen radiating to the back, suggesting pancreatitis was present in 2 patients (4%). Jaundice was present in 30 patients(60%) and Fever was present in 7patients (14%).

According to Wani NA et al, 94% had pain in the right upper abdomen. According to Acosta JM et al (1974)65, gall stones are responsible for 50% of all cases of pancreatitis. Conversely, 4 – 8% of patients with gall stones develop pancreatitis. This was in accordance to our study of pancreatitis in 2 cases (5.8%). Clinical jaundice was present in 16 patients (45.7%) with positive predictive value of 64%. This was roughly in accordance to meta-analysis by Abboud66 (1996) et al which showed jaundice having positive predictive value of 39% for choledocholithiasis.

Past History

6 patients (12%) had documented past history of jaundice, relieved by temporary biliary stent before inclusion in our study. 12 patients (24%)) had recurrent attacks of fever with chills and rigors, suggestive of cholangitis. The most common co-morbid medical illness was DM (30%) followed by HTN (22%)

The specificity of cholangitis in predicting CBD stone was 100% but its sensitivity could not be calculated as no case where history suggestive of cholangitis was present and there was no CBD stone. Fever and pain abdomen may be also due acute cholecystitis but when present with chills and rigors with features of cholestasis; it goes in favour of cholangitis.

According to Abboud BA et al (1996) the specificity of cholangitis in predicting CBD stones was 99%.

ANALYSIS OF LAB INVESTIGATIONS

Serum Total Bilirubin

35(70%) patients had clinical evidence of jaundice (icterus) because their total bilirubin values exceeded the clinical threshold of 2 mg%.Most of the patients had values between 2 to 4 mg% with highest value obtained of 15.6mg%.

The sensitivity of elevated bilirubin in predicting CBD stones in our study was 91.2%. This is more than study done by Abboud66 et al (1996) of 69% sensitivity probably due to advanced presentation of cases with prolonged and significant cholestasis.

The most common group was between 2 to 4 mg% (30%) which is in accordance with Lawrence et al (2003) which says that absolute level usually remain under 10 mg/dl and most are in the range of 2 – 4 mg/dl. Also, in all cases

the direct (conjugated) fraction exceeded indirect which is also in accordance with Lawrence 35 et al (2003).

Alkaline Phosphatase

All patients had raised alkaline phosphatase. Even in 7 cases (14%)where total bilirubin was normal, alkaline phosphatase was raised, suggesting cholestasis.Mean alkaline phosphatase was 273.2 IU/L. Most patients had values between 151 to 250 IU/L. Even in cases where total bilirubin was normal there was elevation of alkaline phosphatase which is in accordance with Lawrence et al (2003) which states that serum alkaline phosphatase level usually rises and may be the only chemical abnormality in patients without jaundice; when the obstruction is relieved, the alkaline phosphatase and bilirubin should return to normal within 1– 2 weeks with the exception that the former may remain elevated longer if the obstruction was prolonged.

ANALYSIS OF IMAGING MODALITIES

Abdominal Ultrasonography :

Gall Bladder

46 patients (92%) had thickened/contracted gall bladder suggestive of chronic cholecystitis. Similarly either sludge or stones were present in 45 patients(90%).3 patients(6%) had a sonologically normal gall bladder with CBD stones which was later confirmed to be primary CBD stones.3 patients (6%) had

undergone cholecystectomy earlier. Our incidence of primary CBD stone was 2.9% which is lower than that quoted by Saharia1 et al (1974) of 4%. This is because of small size of the study than Saharia.The abdominal USG was able to detect gall stones in gall bladder in all cases (100%) which is in agreement with Zinner MJ et al (1997) which states that the presence of associated gall bladder stone can be confirmed >98% of patient with gall stones and dilation of the intrahepatic biliary system can be identified in most.

CBD

All patients had CBD ductal diameter of greater than or equal to 8 mm.The mean CBD diameter was 15.32 mm with most patients having CBD diameter either between 10 to 12 mm(28%).The highest recorded CBD diameter was 25mm. The specificity of USG for CBD stone was
100% which correlates with Abboud BA et al (1996). The specificity of USG was confirmed either with ERCP/per operative cholangiography or intraop assessment of the CBD.

BILE CULTURE

Bile was routinely cultured. Most common organism isolated was E.coli (64%) cases. 6patients (12%) had no evidence of any growth despite of culturing for 48 hrs on both aerobic and anaerobic culture media. Klebsiella was grown in about 9 patients (18%).

The above findings are in partial agreement with that of Wani NA et al (1991) who observed the following:E. coli (72.7%), Klebsiella (18.8%) and Sterile (33.3%).

ERCP

A total of 16 patients were subjected to ERCP in our study.The Specificity of ERCP in confirming CBD stones was 100%, which
compares with that of Frey et al (1982) of 98%. Sensitivity could not be determined as ERCP was only selectively used. All patients underwent ERCP with endoscopic sphincterotomy and stone extraction by either Dormia basket or Fogarty balloon. The success of ERCP in clearing the CBD of stones was 11 out of 16 cases (68.75%), which is in agreement with Freeman M et al (1996), which states that complete clearance of all CBD stones is achieved endoscopically in 71-75% of the patients with the first procedure and 84 – 95% of the patients with multiple endoscopic procedures.

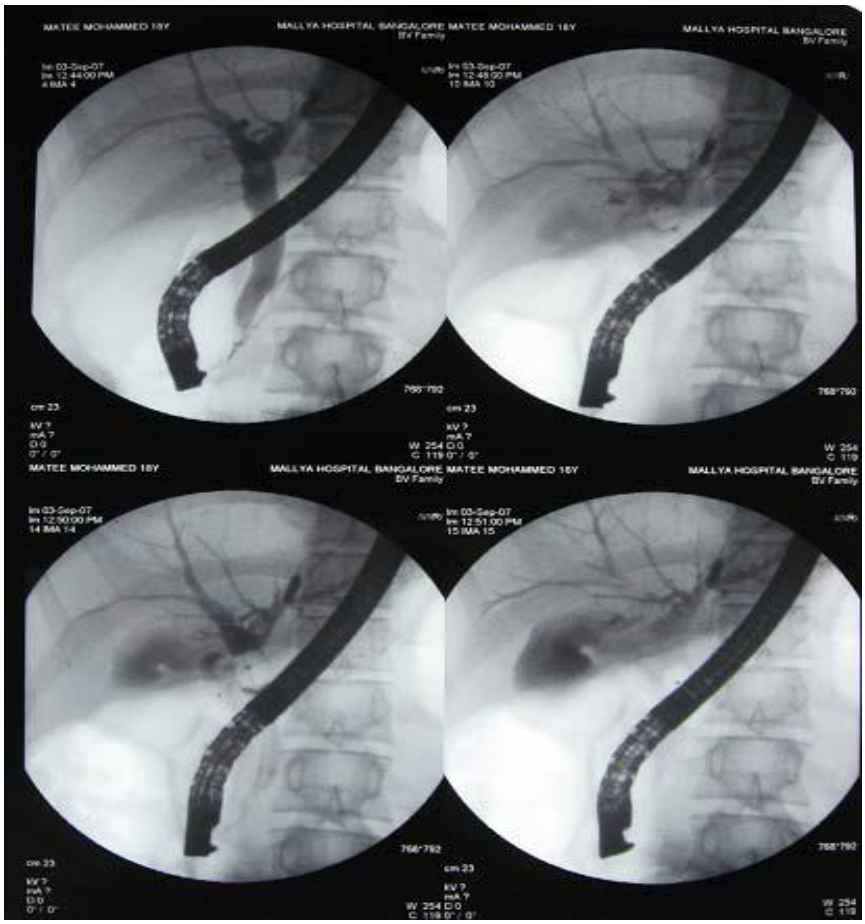
Complications of ERCP

1) Incomplete clearance – 5 cases (31.25%)

2) Post ERCP pancreatitis – 2 cases (12.5%)

The rates of post ERCP pancreatitis varies from less than 1% to 40%. The difference in criteria for determining pancreatitis, method of data collection and patient population (i.e., number of high risk patients included in the published series) are factors likely to affect post ERCP pancreatitis. According to Abdel

Aziz, et al 2007 May. The consensus conference identified pain persisting for 24hrs, associated with hyperamylasemia greater than 3 times the upper limit, as an indicator of pancreatitis (Testoni PA, 2002 Nov.).Our case had a pre ERCP amylase of 52 IU/L (normal range 28 to 100 IU/L) and post ERCP amylase at 24 hrs of 1072 IU/L, which fits into the criteria for post ERCP pancreatitis. The rate impaction of dormia basket is very rare,between 0.3 to 1%2.



C-arm image of ERCP showing successful clearance of CBD calculi

Endoscopic sphincterotomy

PEROP CHOLANGIOGRAM

Only selective cholangiography was performed. Two methods were followed:

1) Trancystic for for pre exploration cholangiogram.

2) Through T – tube after cholodochotomy for post exploration cholangiogram.

Our indication for cholangiography was:

1) Abdominal USG negative for CBD stones, but history and lab data suggestive of CBD stones (serum bilirubin more than 3mg%, elevated serum amylase, history of cholangitis, pancreatitis).

2) Post-exploration to confirm complete clearance of CBD stones especially when multiple stones were retrieved from CBD, but CBD diameter was not sufficient for biliary enteric drainage (<1.2 Cms).

Pre-explorative cholangiogram was possible for CBD stones in all cases.

Mulholland et al 2006, which states that if intra-operative cholangiography is selectively used for the following:

• A dilated CBD

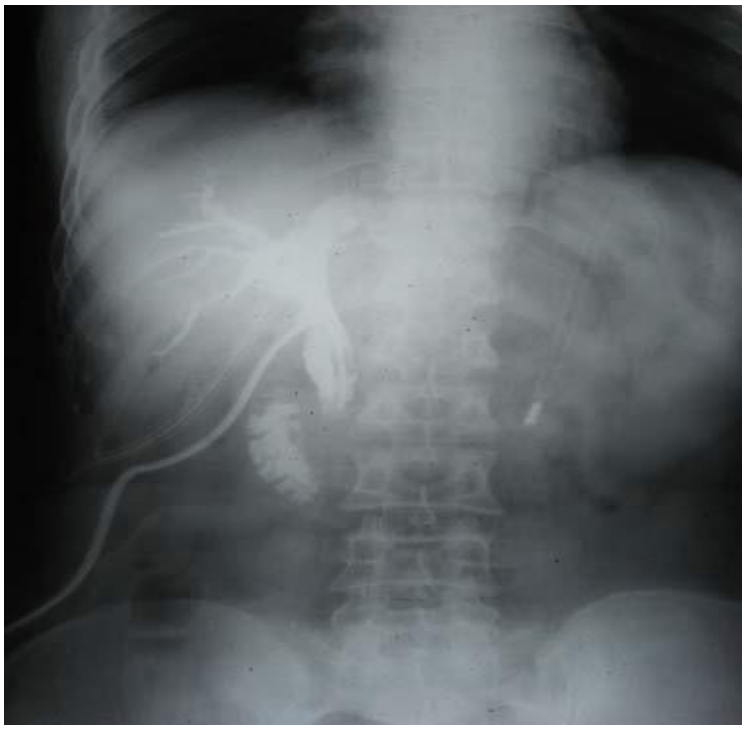
• A wide cystic duct

• Palpable CBD stones

• Elevated LFT

• History of cholangitis, pancreatitis

Approximately 30% of the patients will require intraop cholangiogram at the time of cholecystectomy. Cholangiography was accurate in 100% of the cases in our studies compared to Gerard et al 2000, of 88%.



Per op post-exploration cholangiogram showing flow of dye into the Duodenum

TREATMENT

Out of 50 patients, 16 patients underwent ERCP (32%). ERCP was successful in clearing CBD of stones in 11 cases (68.75%). In 5 cases, temporary stent was introduced due to incomplete clearance in which open CBD exploration was carried out. The total number open CBDE was 39 (68%).

OPEN CBD EXPLORATION:

Procedure Present Study Other Study

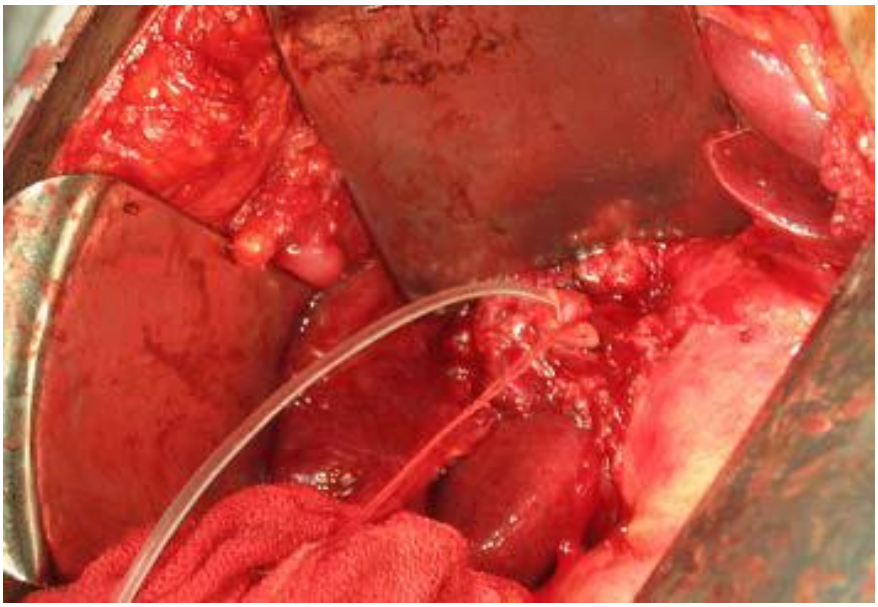
(n = 39) (n = 1132)

1. CBDE + T-tube closure -34(87.18 %) 1050 (92.8%)
2. CBDE + trasnsduodenal sphincteroplasty. - 0 (0%) 45 (4%)
3. CBDE + Choledocho duodenostomy - 4 (10.26%) 35 (3%)
4. CBDE + choledocho jejunostomy. - 1 (2.56%) 0 (0%)
5. Hepaticojejunostomy - 0 (0%) 2 (0.02%)

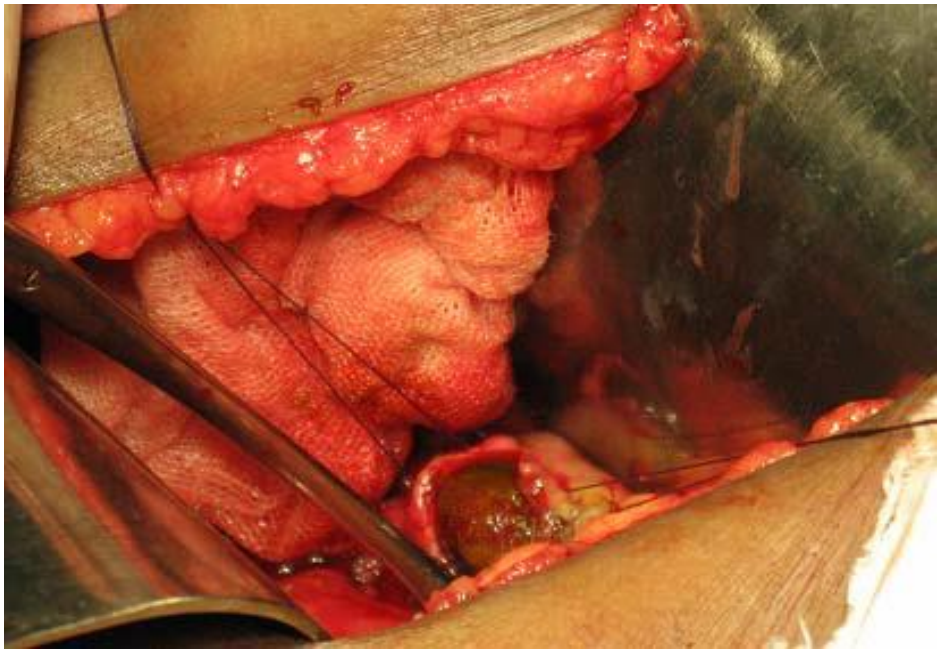
While CBDE with T-tube drainage remained the most common procedure used in open CBD exploration; the biliary enteric drainage procedure of choice in our cases was choledochodudenostomy. Transduodenal sphinctrotomy was avoided as the same could be done endoscopically via ERCP. Choledochodudenostomy was used when the CBD was dilated (at least 12 mm,but preferred diameter was 20 mm and was associated with multiple stones, biliary sludge impacted, giant stones, ampullary stenosis, which is in accordance with the indications given by Blumgart et al 2007. One patient (2.56%) underwent Roux-en-y choledochojejunostomy, as one patient had post gastro jejunostomy status, done for peptic ulcer disease.

Patient had a CBD of 20 mm with multiple stones and pyloric stenosis. Hence choledochoduodenostomy could not be attempted because of duodenal scarring. Overall as a part of biliary enteric drainage choledochoduodenostomy was choosen. This is in accordance with Schein and Gliedmann 1981 which states that choledochoduodenostomy is a safe and simple operation with low morbidity and mortality especially in elderly patients than transduodenal sphincteroplasty .

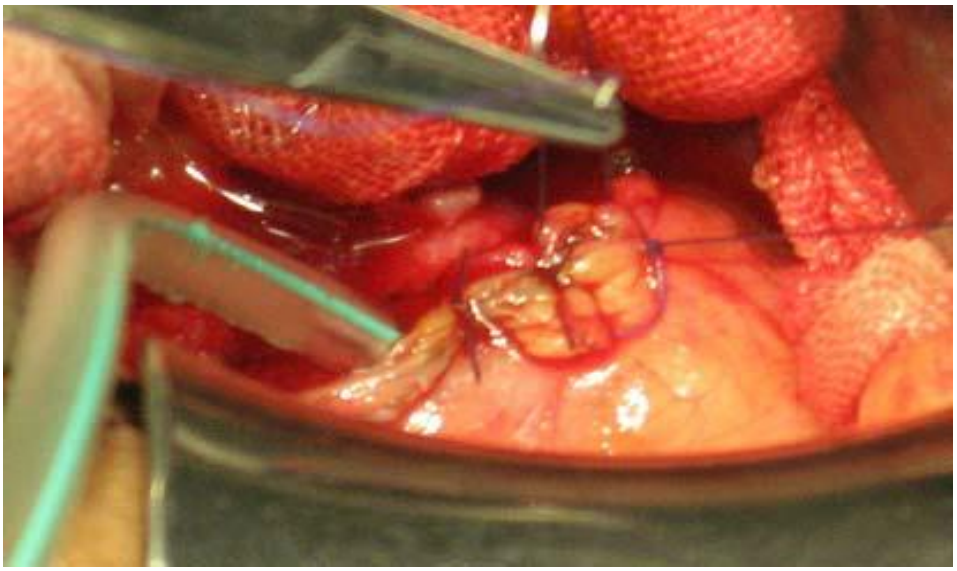
Needle cholodochotomy



Perop trancystic cholangiographic catheter in situ



Open cholodochotomy with stone in situ



Choledochotomy closure on T-tube

10th day T-tube cholangiogram with free flow of bile into duodenum

COMPLICATIONS

1. ERCP

a) Incomplete clearance – 5 cases (31.25%)

b) Post ERCP pancreatitis – 2 cases (12.5%)

Further discussion about the complication of ERCP has been dealt in Diagnostic ERCP section.

2. Open CBD Exploration:

a) Wound infection – 7 cases (17.94%)

b) Bile leak – 1 case (2.56%)

c) Chest infection – 4 cases (10.25%)

d) Retained stone – 0 case (0%)

Morbidity: 30.75%

Mortality: 0%

Wound infection:

7 cases developed wound infection 3rd post op day onwards. As already elucidated in Bile Culture section; infected wounds cultured Klebsiella , Enterococus . This led to extended hospitalization of 8 days on the average, and 2 cases needed secondary suturing of the wound.

Factors predisposing to infections were:

a) Grossly dilated CBD with multiple stones – 5 cases

b) Isolation of Klebsiella and Enterococus in bile culture – 7 cases (100%)

c) Gross contamination of the operating field on open choledochotomy, converting the wound from clean to clean contaminate – 5 cases.

d) History of cholangitis -4 cases.

Bile Leak

1 case (2..56%) developed bile leak because of partial dislodgement of T – tube on post-operative day 8, due to the tugging of the T – tube by the patient. The position of the T- tube was confirmed by T-cholangiogram. Since dye was extravasating into the peritoneal cavity and there was no evidence of residual stone, the T – tube was removed.

Lower Respiratory Tract Infection (LRTI) :

Two cases developed atelectasis followed by lower respiratory tract infection due to the pain of the open surgical wound. The patients were managed with chest physiotherapy and antibiotics. There was no increase in the length of hospitalization due to the above complication.

Retained Stones:

None of the cases had residual stones post procedure or on the tenth day T-tube cholangiogram. This is because

1) Use of biliary-enteric drainage when multiple stones or CBD dilated over cms was present.

2) Confirmation of ductal clearance using perop cholangiogram in doubtful cases. Though our morbidity of 25% is higher than that of Girard and Morin 1993 of 17% but the most frequent complications by them of retained stones, bile leak, wound complications are in line with our study, except for retained stones.

FOLLOW UP:

All patients were followed up on out patient basis with repeated assessment of patients symptomatic status, physical exam, liver function tests and abdominal ultrasonography.68% (34 patients) have been followed up till the time of submission of this study. 14.% (7cases) were lost from follow up after 2 months.

Overall Morbity And Mortality:

While mortality is nil in both open and ERCP procedures the overall morbidity of open procedure was more accounting for 30.75% than ERCP12.5 % .

0 % Mortality in open CBD exploration (Pappas et al, 1990) and endoscopic (Shivak 1989), laparoscopicCBD (Petelin,1993) have been recorded which is in agreement with our study.

Failiure rate:

Out of 16 patients who had undergone ERCP, incomplete clearance of the CBD or retained stones found in 5 patients (31.25%) . These patients had undergone open surgery after ERCP for complete clearance of the duct. Failiure rate of ERCP is more when compared to open CBD exploration.

7. SUMMARY

The study was conducted during the period from June 2011 to December 2013 at Rajiv Gandhi Government General Hospital,Chennai attached to Madras Medical College.A prospective clinical descriptive study consisting of 50 patients was taken. The mean age for male was 47.84 yrs and for female, it was 54.76 yrs. The highest incidence was noted in the 51 – 60 yrs age group. Lowest incidence was in the <30 yrs age group. The female to male ratio was 1.6 CBD stones were found in 6.37% of the cases with Gall Bladder stones. 15 patients (30%) stayed in the hospital for a duration ranging from 8 to 14 days. 26 patients (52%) stayed for a period of 15 to 21 days, 9patients stayed or more than 21 days and no patient was discharged prior to 7 days of admission.

Pain abdomen was present in 44 patients(88%). Severe pain abdomen radiating to the back, suggesting pancreatitis was present in 2 patients (4). Jaundice was present in 30 patients(60%) and Fever was present in 7patients (14%).

6 patients (12%) had documented past history of jaundice, relieved by temporary biliary stent before inclusion in our study. 12 patients (24%)) had recurrent attacks of fever with chills and rigors, suggestive of cholangitis. The most common co-morbid medical illness was DM (30%) followed by HTN (22%)

35(70%) patients had clinical evidence of jaundice (icterus) because their total bilirubin values exceeded the clinical threshold of 2 mg%.Most of the patients had values between 2 to 4 mg% with highest value obtained of 15.6mg%.

All patients had raised alkaline phosphatase. Even in 7 cases (14%)where total bilirubin was normal, alkaline phosphatase was raised, suggesting cholestasis.Mean alkaline phosphatase was 273.2 IU/L. Most patients had values between 151 to 250 IU/L.

44 patients (88%) had thickened/contracted gall bladder suggestive of chronic cholecystitis. Similarly either sludge or stones were present in 45 patients(90%).3 patients(6%) had a sonologically normal gall bladder with CBD stones which was later confirmed to be primary CBD stones.3 patients (6%) had undergone cholecystectomy earlier.

All patients had CBD ductal diameter of greater than or equal to 8 mm.The mean CBD diameter was 15.32 mm with most patients having CBD diameter either between 10 to 12 mm(28%).The highest recorded CBD diameter was 25mm. The specificity of USG for CBD stone was 100% which correlates with Abboud BA et al (1996). The specificity of USG was confirmed either with ERCP/per operative cholangiography or intraop assessment of the CBD.

Most common organism isolated was E.coli (64%) cases. 6patients (12%) had no evidence of any growth despite of culturing for 48 hrs on both aerobic and anaerobic culture media. Klebsiella was grown in about 9 patients (18%).

Per op cholangiogram was used in 3 cases with negative USG for CBD stones and had specificity of 100%.However per op cholangiogram was false positive in 1 case in post exploration cholangiogram bringing its specificity to 83.33% in this scenario.

ERCP had success of clearing the CBD of all the stones in 68.75% of the cases. It failed in 5 cases (31.25%) for which a temporary stent was left followed by open CBD exploration.2 patients(12.5%) developed post ERCP pancreatitis.

39 patients were subjected to open CBD exploration which also include 5 failed cases of ERCP. 34 patients (87.18%) underwent CBDE with T-tube closure. 4 patients (10.26%) underwent choledochoduodenostomy . 1 case(2.56%) underwent choledochojejunostomy as the patient had a scarred duodenum from acid peptic disease and had undergone Gastrojejunostomy earlier.

68% (34 patients) have been followed up till the time of submission of this study. 14.% (7cases) were lost from follow up after 2 months.

While mortality is nil in both open and ERCP procedures the overall morbidity of open procedure was more accounting for 30.75% than ERCP12.5 % .0 % Mortality in open CBD exploration .

Out of 16 patients who had undergone ERCP, incomplete clearance of the CBD or retained stones found in 5 patients (31.25%) . These patients had undergone open surgery after ERCP for complete clearance of the duct. Failiure rate of ERCP is more when compared to open CBD exploration.

8. CONCLUSION

The management of CBD stones has been subject to much debate during the past several years, especially with the advent of new laparoscopic techniques and greater expertise of endoscopic procedures. This study was undertaken to get a clinical perspective of CBD stones in the milieu of GB stones and to determine the optimal approach for the management with the age of the patient, general condition, complicating factors, availability of endoscopy and minimally invasive procedure, determining the algorithm of treatment. The end result of our study was the developing of a management protocol in our setting.

- CBD stones were present in 6.37% of gall bladder stone cases encountered.
- There was a steady rise of incidence of CBD stones beyond the age of 55 yrs with female patients outnumbering the males.
- Patients spent an average of 18.3 inpatient days for the treatment of CBD stones.
- Elevated bilirubin was a positive predictor of CBD stones in 88.2% of the cases. Elevated alkaline phosphatase was a further confirmatory index of cholestasis.
- Transabdominal ultrasonography was the imaging modality commonlyused to detect CBD stones, as it was cost efficient, easily available, able to detect gall bladder stones in all our cases and CBD stones in 91% of our cases. It

was also used to measure CBD diameter which helped us to individualize the management based on it.

- Perop cholangiogram was used selectively when USG was doubtful of CBD stones, yet history and biochemical parameters suggestive of it. It was also used when confirmation of complete clearance of CBD of the stones was necessary peroperatively in order to avoid any biliary enteric drainage, because of insufficient ductal diameter for the same.
- Patients with CBD stones with acute biliary pancreatitis,cholangitis needing immediate decompression of CBD, patient who had already undergone cholecystectomy and patients with minimally dilated CBD where open exploration would have carried greater morbidity were subjected to ERCP.
- Bile culture in our cases revealed E.coli as the most common organism, but in relation to complications in terms of post-op wound infection, cholangitisklebsiella, enteroccocus out numbered E.coli. Our most common treatment modality was open CBD exploration with closure of choledocotomy on T-tube being the most common procedure.
- Biliaryenteric drainage in the form of choledochoduodenostomy, choledochojejunostomy was done in selective cases. Open CBD exploration was the last resort for failed minimally invasive treatment, like ERCP and lap

CBD exploration. The benefit of open CBD exploration exceeded its morbidity with zero mortality in well chosen cases.

To conclude, there can be no definite algorithm for the management of CBD stones as the patients' age, underlying general condition being the only standardizable factor with facilities for endoscopic, laparoscopic management being variably available from institution to institution and hence, necessitating tailoring the management of CBD stones depending upon the Institution's resources.

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10. ANNEXURES

PROFORMA

NAME IP NO

AGE DOA

SEX DOS

ADDRESS DOD

PRESENTING COMPLAINTS

Pain Abdomen Right upper quadrant pain

Radiation to back

Jaundice pale stools

High colored urine

Itching

Fever

Others(specify)

PAST HISTORY

Jaundice

Fever/pain

Diabetes mellitus

Hypertension

PREVIOUS SURGERY

Biliary

Non biliary

INVESTIGATIONS

Hb%	PT
TC,DC	aPTT
RBS(FBS/PPBS)	Chest X ray
Blood Urea	ECG
Serum Creatinine	
Liver Function Test	
Serum Bilirubin- Direct	
Indirect	
Alkaline phosphate	
AST	
ALT	
GGT	
Total Protein	
Serum albumin	
Serum globulin	

Serum amlyase(if necessary)

USG: Gall Bladder Wall

Stones

CBD Size

Stones

Liver Intra hepatic biliary dilation

Others (specify)

ERCP: CBD Diameter

Stones

BILE CULTURE: Organism cultured

TREATMENT:

ERCP Pre/Post Cholecystectomy

Indication

Results

Complications

OPEN SURGERY Per op Cholangiogram

Indication

Biliary Enteric drainage

10th day T-tube cholangiogram report

Result

10.MASTER CHART

S.No	IP No.	NAME	AGE	SEX	TYPE OF PROCEDURE	HOSP. STAY	USG CBD CALCULI	USG CBD DIAMETER (IN MM)	CONJ.BILIRUBIN	POST.OP COMPLICATIONS
1.	55080	SAKUNTHALA	28	F	ERCP	8	SINGLE	10	0.6	
2.	65228	DEIVANAI	53	F	CBDE+CD	17	NIL	8	0.8	SSI
3.	65432	DURGAI	51	F	ERCP	11	MULTIPLE	17	3.7	
4.	66232	ANBUJAM	62	F	CBDE+T-TUBE	12	MULTIPLE	8	1.7	
5.	60163	ANANDAN	29	M	CBDE+CD	15	MULTIPLE	15	5.9	
6.	65590	ARJUNAN	53	M	ERCP	10	SINGLE	8	0.9	PANCREATITIS
7.	70766	FIAZ	45	M	CBDE+T-TUBE	11	MULTIPLE	11	2.9	
8.	70163	SUYAMBAKANI	55	F	CBDE+T-TUBE	17	NIL	9	0.9	LRTI
9.	69439	INDIRANI	47	F	CBDE+T-TUBE	23	MULTIPLE	19	5.8	
10.	6104	SUDHA	34	F	CBDE+CD	17	MULTIPL	15	5.5	BILE LEAK

	1						E			
11.	7210 3	SEETHARAMAN	66	M	ERCP	11	SINGLE	11	2.8	
12.	1098 3	SELVARANI	32	F	CBDE+T-TUBE	25	NIL	12	5.6	
13.	5471 1	KOKILA	63	F	CBDE+T-TUBE	18	SLUDGE	11	2.3	SSI
14.	5947 1	BHAVANI	25	F	ERCP	13	SINGLE	14	5.4	
15.	6541 1	SANTHA	62	F	CBDE+T-TUBE	26	MULTIPL E	8	0.8	
16.	7002 9	GYATHRI	47	F	CBDE+T-TUBE	29	SINGLE	10	2.8	
17.	6349 9	THANGARAJ	27	M	ERCP	14	MULTIPL E	16	5.3	
18.	7795 9	RADHAKRISHNAN	61	M	CBDE+T-TUBE	30	MULTIPL E	12	4.9	SSI
19.	7883 7	CHELLAN	33	M	CBDE+T-TUBE	12	MULTIPL E	8	0.9	
20.	7883 2	BHUVANESWARI	37	F	CBDE+T-TUBE PRE.ERCP INCOMPLETE	18	MULTIPL E	11	5.1	
21.	7180 4	RAJENDRAN	50	M	ERCP	9	SINGLE	9	2.9	
22.	8764 1	RAVI	35	M	CBDE+T-TUBE	13	SINGLE	14	4.2	LRTI
23.	8347	CHITHRA	38	F	CBDE+T-TUBE	14	MULTIPL	13	4.7	

	2						E			
24.	85090	RAMACHANDRAN	63	M	CBDE+T-TUBE	16	MULTIPLE	10	2.9	
25.	92572	RUCKMANI	61	F	CBDE+T-TUBE PRE.ERCP INCOMPLETE	19	MULTIPLE	16	4.6	SSI
26.	87343	VASANTHI	41	F	CBDE+T-TUBE	23	SLUDGE	11	2.8	
27.	84381	KANNIAPPAN	55	M	CBDE+CJ	20	MULTIPLE	15	4.2	
28.	55172	VADIVU	54	F	CBDE+T-TUBE	17	MULTIPLE	13	2.9	
29.	67623	TAMILARASI	43	F	CBDE+CD	24	MULTIPLE	14	2.4	
30.	89109	KANNAN	70	M	ERCP	19	SINGLE	11	2.2	PANCREATITIS
31.	21342	MANOHARAN	54	M	CBDE+CD	24	MULTIPLE	9	0.9	
32.	18657	ELLAMMAL	52	F	CBDE+T-TUBE PRE.ERCP INCOMPLETE	13	MULTIPLE	10	2.5	
33.	17656	VENKATAMMAL	57	F	CBDE+T-TUBE	11	MULTIPLE	12	2.8	
34.	34859	RENUKA DEVI	47	F	ERCP	08	MULTIPLE	10	2.7	
35.	45236	AIYSHA BEEVI	51	F	CBDE+T-TUBE	15	MULTIPLE	14	4.9	
36.	6574	RAJESH	25	M	CBDE+T-TUBE	19	MULTIPL	15	4.1	LRTI

	3				PRE.ERCP INCOMPLETE		E			
37.	6759 1	VENDA	42	F	ERCP	15	MULTIPL E	13	2.9	
38.	7865 1	RAJA	44	M	CBDE+T-TUBE	17	MULTIPL E	11	2.7	SSI
39.	9876 2	ANBUKARASI	58	F	CBDE+T-TUBE	15	SLUDGE	9	0.7	
40.	8821 7	EAMBARAM	62	M	ERCP	16	MULTIPL E	10	2.2	
41.	1109	AMBUJAM	72	F	CBDE+T-TUBE	16	MULTIPL E	19	12.7	LRTI
42.	8971	KANAKA	42	F	CBDE+T-TUBE	17	MULTIPL E	11	2.9	
43.	1109 4	PARAMASIVAM	42	M	CBDE+T-TUBE	15	MULTIPL E	12	4.6	
44.	3289 4	RAJESWARI	54	F	CBDE+T-TUBE	18	MULTIPL E	21	11.9	SSI
45.	4572 8	BASHA	48	M	CBDE+T-TUBE	15	MULTIPL E	14	4.9	
46.	5436 2	BABYAMMAL	52	F	CBDE+T-TUBE PRE.ERCP INCOMPLETE	18	MULTIPL E	`15	4.6	
47.	7625 2	MURUGAMMAL	42	F	CBDE+T-TUBE	19	MULTIPL E	18	10.7	
48.	8975 5	MALARODI	49	F	CBDE+T-TUBE	16	MULTIPL E	17	4.5	

49.	90213	RAMASAMY	59	M	CBDE+T-TUBE	25	MULTIPLE	15	4.7	
50.	785	VIMALA	68	F	CBDE+T-TUBE	29	MULTIPLE	25	15.6	SSI